ATC 01, Rev 4: Alternative 3 Interchange Configuration – A-Line

Washington State Department of Transportation

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October 3, 2018

Buck Allen
Hamilton Construction Company
1850 93rd Avenue SW
Olympia, WA 98512

RE: I-82 South Union Gap Interchange – Construct Ramps, ATC 01, REV 4: Alternative 3 Interchange Configuration – A-Line

Mr. Allen:

WSDOT has reviewed Hamilton's **I-82 South Union Gap Interchange – Construct Ramps, ATC 01, REV 4: Alternative 3 Interchange Configuration – A-Line**, as submitted on October 1, 2018. WSDOT's determination regarding this ATC is as follows:

The ATC is approved.

Please contact me if you have any questions.

Sincerely,

Bob Hooker, P.E.
Design Project Engineer

HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS

WSDOT

I-82, SOUTH UNION GAP INTERCHANGE - CONSTRUCT RAMPS

ATC 01, REV 4: ALTERNATIVE 3 INTERCHANGE CONFIGURATION - A-LINE

HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS

Brief Description

ATC 01: Alternative 3 Interchange Configuration – A-Line

Detailed Description

This ATC proposes to utilize an alternative configuration for the completion of the I-82 South Union Gap Interchange as previously presented as Alternative 3 Interchange Configuration (*see Appendix A*). This ATC details the specific changes being proposed for the A-Line reconfiguration as they relate to the M1 Conceptual Plans. While requiring modifications to the RFP detailed below, this ATC meets the RFP requirement of providing a new "eastbound off-ramp into the city of Union Gap from I-82 to provide full access to W. Ahtanum Road via the City of Union Gap's future Regional Beltway project." The alignment being proposed in this ATC provides WSDOT, stakeholders, local businesses and the traveling public with a number reduced impacts and benefits that are summarized below:

TABLE 1 – Proposed A-Line, Reduced Impacts & Benefits (*All quantities are approximate)

Element	Proposed A-Line	WSDOT Conceptual A-Line
Wetlands	0.00 AC	0.14 AC
Floodplain Impact, Surf. Area (Impervious Area)	3000 SY	7100 SY
Traffic Flow	Single Merge Point to Main St	Two Merge Points to Main St
Safety - **Total Crash Frequency** **Fatal Injury Crash Frequency** **Incapacitating Injury Crash Frequency**	 8.517 crashes/15 yr 0.108 crashes/15 yr 0.329 crashes/15 yr	 9.657 crashes/15 yr 0.114 crashes/15 yr 0.345 crashes/15 yr
Roadway Design Criteria	Equal or Better (***See Appendix D***), Meets Roadway Design Criteria	Meets Roadway Design Criteria
Temp. Construction Impacts – A-Line Construction	Apprx 1 month	Apprx 3+ months
Temp Construction Impacts – C-Line Surfacing Work as it relates to A-Line Construction.	0.15' HMA Overlay Only - Requires 2 night shifts with ramp closures or detour/traffic shifts.	Full Depth Re-Construction - Requires apprx 3 weeks of extended ramp closure or detour/traffic shifts.
Env. Permit Violation Risk, TESC/HCSF Needs	300 LF of HVSF	2200 LF of HVSF
Excavation	1800 CY	4000 CY
CIP Retaining Walls	2300 SF	8500 SF
Roadway Shoring	2300 SF	8500 SF
HMA	1300 TN	3000 TN
CSBC	1400 TN	3300 TN
Guardrail	300 LF	1600 LF

Concrete Barrier	500 LF	800 LF

Additional information providing a detailed description of this ATC is contained in the ATC appendices. The various appendices are summarized in the table below and are referenced throughout the ATC:

TABLE 2 – ATC Appendices

Appendix	Description	Page Number
A	Alternative 3 Plan View	10
B	Plan/Profile/Roadway Section	11-12
C	PM Peak Traffic Volumes	13
D	Design Parameters Worksheet	14-17
E	Draft IJR Executive Summary & Policy Point Revisions	18-19
F	Conceptual Staging Plan View	20
G	ISATe Crash Analysis	21-22

Usage

This ATC will be used to revise the A-Line alignment from the WSDOT M1 Conceptual Plan.

Subsurface Investigation

This ATC is based on existing WSDOT Geotechnical data within the interchange area including use of WSDOT borings for the existing bridges. Our geotechnical firm has reviewed the existing data and the existing borings are considered sufficient for preliminary design. A limited number of supplemental borings may be advanced during final design to confirm the existing data and the elevations of geologic units near planned foundation locations as refinement to the preliminary design.

Proposed RFP Modifications

Items presented below are only those elements indicated in the RFP which require modification based on the proposed ATC. Portions of RFP sections containing modifications that are otherwise unmodified are not shown here.

Modify 1-01.3(1), as follows:

Basic Configuration – *The following required elements shown in the Conceptual Plans and/or Pre-Approved Design Analyses, as such elements may have been modified (with WSDOT's permission) in the Proposal:*

- *Number and width of proposed roadway lanes and shoulders:*

- *A-Line number of lanes will be maintained but tapers, widths and shoulders will be modified.* ***(Overall alignment has been modified. See Appendix B and Appendix D for details)***
- *B-Line number of lanes will be maintained but tapers, widths and shoulders will be modified.* (B-Line as shown in M1 Conceptual Plans is being proposed for modification with Hamilton ATC 02. The proposed A-Line alignment in this ATC will overlap with the M1 Conceptual B-Line, thus will modify the B-Line)
- *M-Line number of lanes, widths and shoulders will be modified.* (M-Line modifications are minor in nature and will be detailed in the proposal)

- *Type and location of guardrail*
  - *Guardrail location and quantity will be modified with the proposed A-Line. The quantity will be significantly reduced.*
- *Limits of HMA paving****
  - *The HMA paving limits will be modified on the A-Line, B-Line and M-Line with the proposed A-Line modification. While the limits of paving will be adjusted, the paving depths will be maintained as required in the RFP and M01 Conceptual Plans. Roadway Section A (1.40' overall depth, Sheet RS1) as shown in the conceptual plans will be utilized for the proposed A-Line.*

Modify 2.19 Signing

2.19.1 – *General, supplement with the following:*

- *Additional signing required with the approval of this ATC will be included in the design and will be installed on the project per applicable Mandatory Standards and shall be the responsibility of the Design-Builder.*

Modify 2.21 Traffic Operations

2.21.3 – *Performance Requirements*

Performance Requirements – See attached preliminary traffic analysis (*Appendix C*) on traffic volumes anticipated with the proposed Alternative 3 interchange configuration. The outcome of the preliminary traffic analysis is that the proposed A-Line modification results in equal or better performance as it relates to traffic volumes.

Design Analyses

No design deviations and associated design analyses are required for this ATC.

Analysis

a) Functionality

Summary

Utilizing the proposed A-Line from the Alternative 3 interchange configuration will result in equal or better functionality of the South Union Gap Interchange. The traffic volumes for our proposed A-line are anticipated to be the same as the WSDOT Traffic Volume Analysis for the A-Line configuration of the M1 Conceptual Plans (see *Appendix C*). A preliminary Level of Service analysis indicates equal or better functionality of the proposed A-Line. Furthermore, safety-related impacts including expected crash totals are reduced with the proposed A-Line. *See Table 3* below for additional quantitative comparison.

Functionality as it relates to meeting roadway design requirements are illustrated in the attached Design Parameters Worksheet (*Appendix D*), which indicate the proposed A-Line as being equal or better. Additionally, see *Appendix E* for the Executive Summary highlighting the suggested Policy Points modifications that will be included in an Interchange Justification Report amendment, if determined to be required post-award.

b) Structural Adequacy

This ATC will have no negative impacts on the structural adequacy of the project and the proposed A-Line modification will greatly reduce the need for retaining walls when compared to the WSDOT Conceptual A-Line. A small retaining wall may be required to retain fill below the existing Bridge 97/145E at the location that the proposed A-Line passes to the East of the West Abutment. That wall, if needed, will meet all standard WSDOT roadway and roadside restoration design requirements.

c) Safety

The proposed A-Line modification provides an improved roadway alignment as it relates to safety of the traveling public and WSDOT maintenance crews. See *Appendix G* for ISATe crash analysis data for both the WSDOT Conceptual A-Line and our proposed A-Line which indicates a reduction in the expected number of crashes. A summary of safety related benefits is illustrated below in Table 3.

TABLE 3 – Safety of Proposed A-Line

Element	Proposed A-Line	WSDOT Conceptual A-Line
1) Total Crash Frequency*	8.517*	9.657*
Fatal Crash Frequency*	0.108*	0.114*
Incapacitating Injury Crash*	0.329*	0.345*
2) Traffic Flow & Safety	1 merge point to Main St	2 merge points to Main St
3) Maint. Impacts Reduced	300 LF Guardrail 500 LF Concrete Barrier 3000 SY HMA	1600 LF Guardrail 800 LF Concrete Barrier 7000 SY HMA

4) Schedule (entire interchange construction)	Apprx Substantial Completion end of August w/ proposed A-Line	Apprx Substantial Completion end of September w/ WSDOT A-Line
5) Construction Operations Reductions, items reduced:	Shoring, Retaining Wall, Excavation, Material Haul-In (HMA, CSBC, concrete, rebar and structure backfill)	

* ISATe analysis study period from 2020-2035, unit of measure is crashes per 15 years

Safety Improvement Narratives

1. Total expected crashes are reduced (including fatal and incapacitating crashes) with the proposed A-Line modification compared to the WSDOT Conceptual A-Line.
2. The added merge from EB I-82 Off-Ramp onto Main St is eliminated and incorporated into the existing NB US 97 Off-Ramp loop, maintaining a single merge point on Main St.
3. Guardrail, concrete barrier and asphalt surfaces generally require maintenance over time. Reducing quantities of items requiring maintenance reduces the potential safety impacts of maintenance crews being exposed to the traveling public and the traveling public to the distraction and safety hazard of maintenance crews on the roadway.
4. All safety impacts of construction operations along actively traveled roadways will be reduced by approximately one month. With the Alternative 3 concept, including the A-Line modification, the interchange will be fully functional in the ultimate configuration in late August, which is a significant safety benefit to all roadway users and a benefit to freight mobility by keeping trucks on highways rather than self-detouring around the work zones through local agency surface streets.
5. The proposed A-Line modification reduces the amount of roadway shoring and retaining wall construction by approximately 70% and excavation by approximately 50%. These operations involve an inherent safety risk to construction crews and the traveling public and by reducing the extent of the work dramatically reduces the safety risks associated with them. Additionally, HMA, concrete, rebar, CSBC and structure backfill quantities are reduced which will subsequently reduce the construction truck traffic and related safety impacts on the traveling public.

d) Comparison of Life Cycle Costs, Including Repair and Maintenances

The utilization of our proposed A-Line results in a reduction in several elements of the project that generally require long-term maintenance. In reducing long-term maintenance needs, the proposed A-Line modification will result in reduced life cycle costs.

TABLE 4 – Proposed A-Line Reduction in Elements Requiring Repair and Maintenance (*All quantities are approximate)

Element	Proposed A-Line	WSDOT Conceptual A-Line
CIP Retaining Walls	2300 SF	8500 SF
HMA	1300 TN (3000 SY)	3000 TN (7100 SY)

CSBC	1400 TN	3300 TN
Guardrail	300 LF	1600 LF
Concrete Barrier	500 LF	800 LF

WSDOT Project Oversight

In reducing the project duration by one month, Alternative 3 also reduces WSDOT project oversight and inspection needs by one month. This will reduce the associated oversight and inspection costs for the month of schedule reduction. As well as reducing WSDOT oversight and inspection costs, WSDOT management personnel will be able to fully engage project close-out a month earlier and be available for new assignments sooner, therefore aiding in streamlining South Central Region construction operations.

e) Aesthetics

All aesthetic treatments as well as roadside restoration requirements per the RFP and Appendix L will be incorporated into the Alternative 3 interchange and the proposed A-Line. Despite the significant reduction in retaining wall size and proposed shift in the A-Line, Hamilton is committed to providing WSDOT, Union Gap and Yakima the aesthetic treatments that have become commitments for the project. With that in mind, Hamilton will work with WSDOT and stakeholders to determine reasonable substitute locations for aesthetic treatments for those indicated along the WSDOT Conceptual A-Line.

f) Impacts on Construction Traffic

TABLE 5 – Reduced Impacts to Construction Traffic

Reduced Impact	Proposed A-Line	WSDOT Conceptual A-Line
Full Construction of A-Line	Apprx 1 month	Apprx 3 months
Roadway Section Construction on C-Line (As it relates to A-Line Construction)	Apprx 2 night shifts with ramp closure or detour/shift to complete 0.15' mill and HMA overlay.	Apprx 3 weeks full night closures or detour/shift to complete full depth roadway section removal and reconstruction.

The proposed A-Line modification minimizes impacts to construction traffic during construction, increases freight mobility and reduces the overall construction schedule by one month, therefore providing equal or better construction-related maintenance of traffic. Reduced schedule will minimize impacts to the heavy freight traffic during the annual fruit and hop harvest that takes place during the late summer and early fall, which is the anticipated timeframe for achieving substantial completion on the project.

g) Effect on Environmental Commitments

The Alternative 3 interchange configuration will maintain all environmental commitments as described in the RFP as equal or better, as well as provide the betterments described below.

TABLE 6 – Proposed A-Line Reduction of Environmental Impacts

Element	Proposed A-Line	WSDOT Conceptual A-Line
Wetland Impact	0.00 AC	0.14 AC
100-YR Floodplain, LF of New Roadway	1000 LF	2500 LF
Impervious Surfaces	3000 SY	7000 SY
Overall Schedule Reduction* (Complete Interchange)	Apprx 6 months	Apprx 7 months

* Related to a reduced carbon footprint of the project

Mitigation of Wetland Impacts

Utilizing the proposed A-Line modification will eliminate all wetland impacts specific to that alignment. The WSDOT M1 Conceptual A-Line impacted wetlands by 0.14 acres whereas our proposed A-Line has no impact to wetlands. Furthermore, the elimination of the WSDOT M1 Conceptual A-Line in-turn eliminates the inherent environmental risk and potential impact of 1600 LF of new construction that is immediately uphill of a designated wetland and is largely outside of WSDOT ROW. Lastly, it is understood that if the actual impact to the wetlands related to the proposed A-Line modification requires re-permitting beyond that which is understood to be handled by WSDOT (permitting and mitigation beyond 0.14 AC but less than 0.50 AC), any costs related to mitigation and schedule impacts and will be borne by the design-builder.

Reduced Carbon Footprint

Our Alternative 3 concept will dramatically reduce the carbon footprint for this project by:

1. Eliminating one month of construction operations and the carbon emissions from construction equipment.
2. Eliminating one month of traffic impacts and the carbon emissions from the traveling public being slowed down through the construction site.
3. Reducing quantities of construction materials that traditionally require significant trucking into and/or out of the project site such as concrete, HMA, construction aggregates (borrow, base course, backfill, bedding) and roadway excavation. *See Table 4* above for additional quantity reductions created with use of the proposed A-Line modification.
4. Reducing quantities of prefabricated construction materials such as guardrail, cable-barrier, TESC items and reinforcing steel (elimination of drilled shafts and significant reduction in retaining walls) further reduces trucking needs as well carbon footprint related to manufacturing processes.

h) Impacts to Surrounding and Adjacent Communities

The proposed A-Line modification will reduce the impacts to the surroundings and adjacent communities, as highlighted below.

Schedule Reduction

The proposed A-Line modification will reduce the construction schedule on the project by one month, thus reducing all associated impacts to the surrounding and adjacent communities by one month, as well. The impacts that will be reduced by a full month include: construction traffic impacts including freight mobility, adjacent business access, noise impacts, visual distraction impacts, safety impacts, and environmental impacts.

Traffic Flow Improvements, Proposed A-Line

The added merge from EB I-82 Off-Ramp onto Main St is eliminated and incorporated into the existing NB US 97 Off-Ramp loop, maintaining a single merge point on Main St.

i) Changes to Noise Walls

Preliminary analysis shows little increase in noise levels at the single-family homes off Main Street or receptors within Fullbright Mobile Home Park in comparison to the existing condition or WSDOT's Baseline configuration. It is not anticipated that the receptors would experience an appreciable noise increase over existing conditions (equal or greater than 10 dBA) if the proposed A-Line or the WSDOT M1 Conceptual A-Line was built.

j) Impacts on Utilities and Rail

The proposed A-Line modification will have no negative impacts on the utilities, ITS or illumination plan shown in the Appendix M1 Conceptual Plans or the RFP. The facilities being installed above the A-Line retaining walls on Conceptual plansheet ITS3 will be installed in revised locations which will maintain all RFP requirements noted in sections 2.16 and 2.18.

k) Discussion of Additional Right of Way or Easements Required

The proposed A-Line modification will not require additional Right-Of-Way or easements for construction.

Appendix A

250 0 250 500
SCALE IN FEET

SR 97/82 JOB NO.xxxx SHEET ___ OF ___

FILE NAME:	I:\BLV\OPPORTUNITIES\000014415\03_LOI-SOQ-Proposal\05_Graphics\03_CADD\14415-ALTS-COMBINED-with google-aerial.dwg				
TIME:	4:47 PM	RELEASE FOR CONSTRUCTION RECORD		REGION / STATE	FED.AID PROJ.NO.
DATE:	July 30, 2018			NWR / WA	FAPNO
PLOTTED BY:	nbateman			JOB NUMBER	
DESIGNED BY:				JobNo	
ENTERED BY:				CONTRACT NO.	LOCATION NO.
CHECKED BY:				ContNo	LOC
PROJ. ENGR.	A. BUTTERS				
		DESCRIPTION	DATE	NO.	

CONCEPT DESIGN
NOT FOR CONSTRUCTION
DRAFT 07-30-2018

Washington State Department of Transportation
HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS
LOCHNER

I-82 / SR 97
UNION GAP
INTERCHANGE

ALTERNATIVE 3 - LOCHNER A

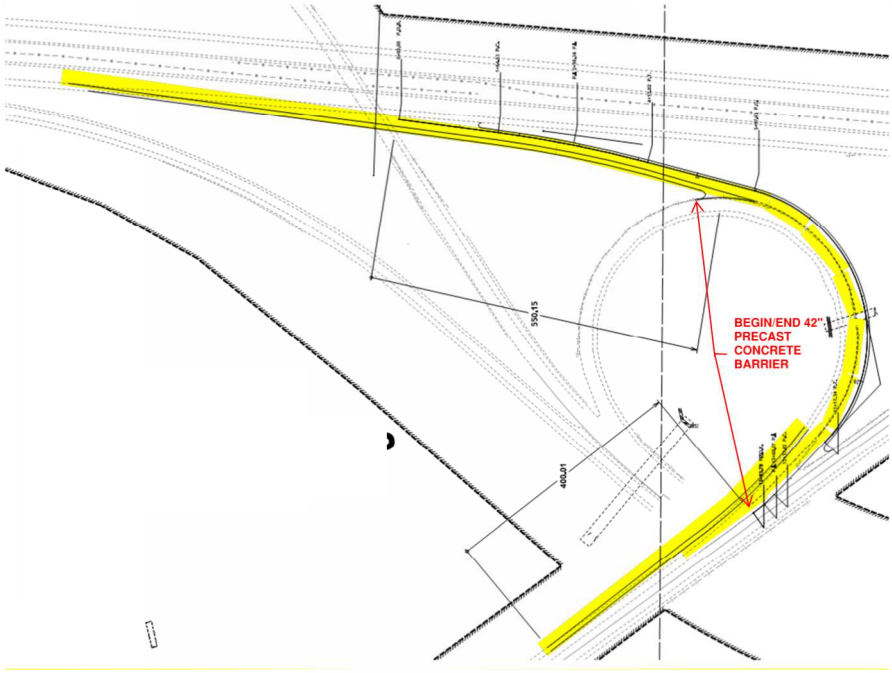
PLAN REF NO

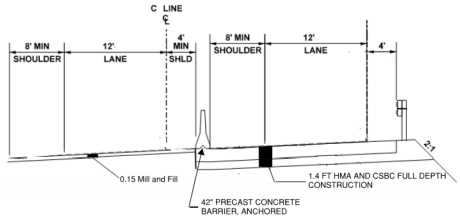
SHEET OF SHEETS

Appendix B

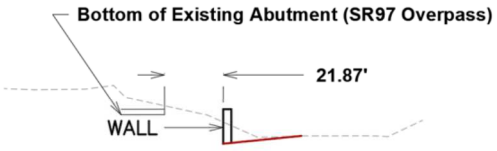
Alt 3, Proposed A-Line: *EB-82 to NB Main St*

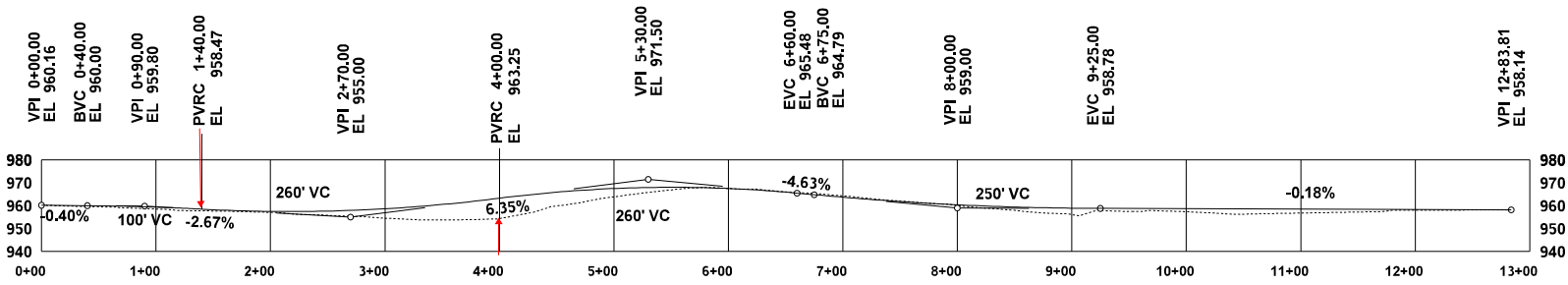
- Ramp design speed: 25 mph
- Mainline design speed: 60 mph
- Taper/Merge length along Main St: 405 ft
- Horizontal Curve R = 250ft (135ft min, Exhibit 1250-4b)
- Stopping Site Distance: 250ft min (142.5 ft minimum, Exhibit 1260.03)
- Deceleration lane length : 550 ft (460 ft minimum, Exhibit 1360-10)
- Taper Rate: 20:1 (15:1 minimum, Exhibit 1360-14a)





Roadway Section

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EL 959.00
EVC 9+25.00
EL 958.78
VPI 12+83.81
EL 958.14
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960
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940
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-2.67%
260' VC
6.35%
260' VC
-4.63%
250' VC
-0.18%
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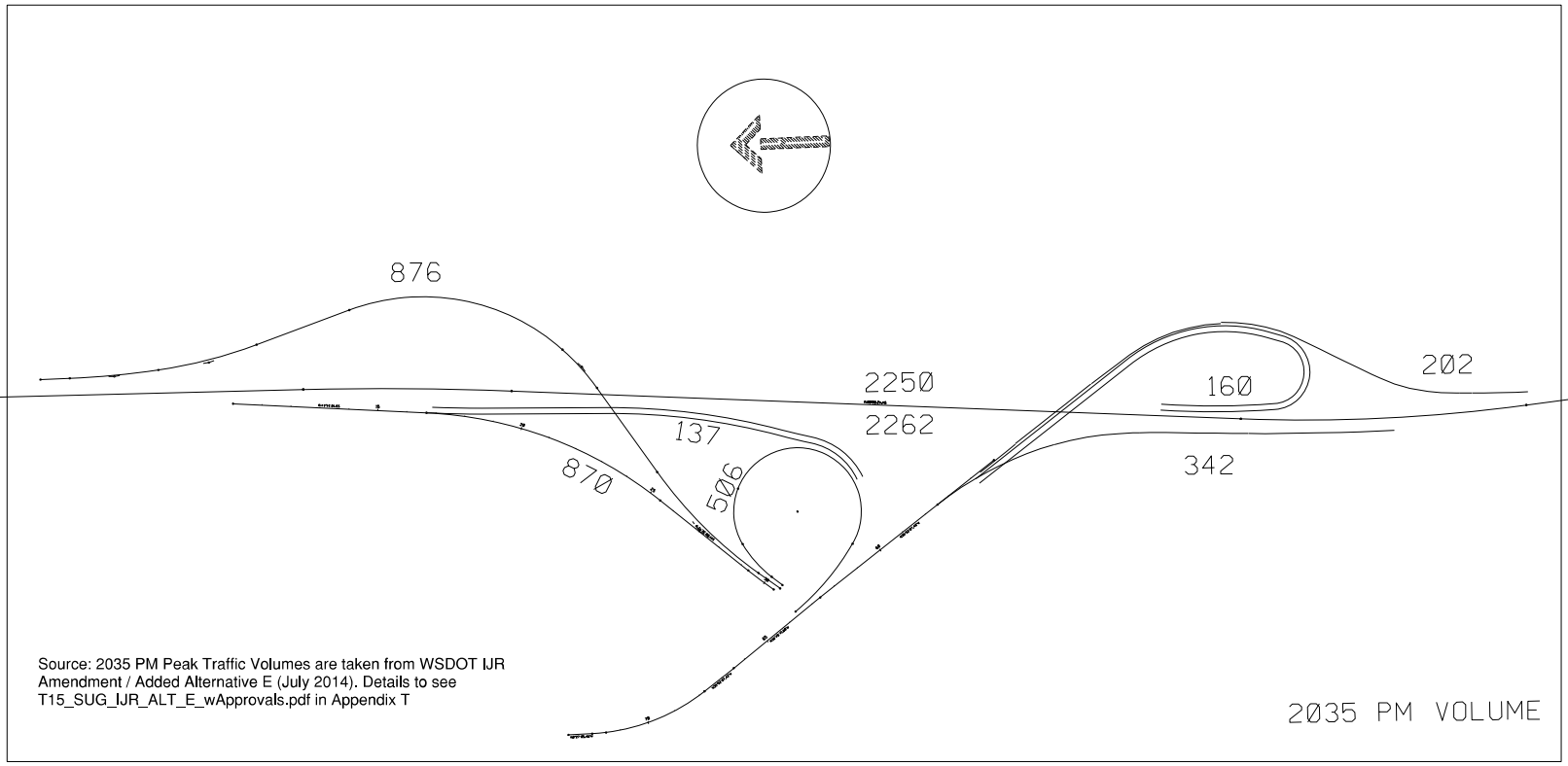
A Line

Appendix C


876
2250
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160
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137
870
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342
Source: 2035 PM Peak Traffic Volumes are taken from WSDOT IJR Amendment / Added Alternative E (July 2014). Details to see T15_SUG_IJR_ALT_E_wApprovals.pdf in Appendix T
2035 PM VOLUME

Appendix D (A-Line DPW)

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
1. Lane	Number of Lanes	X	All Lines Throughout Project	1 Lane	1 to 2 Lanes	1 Lane	DM Exhibit 1360-6
	Lane Type	X	All Linee Throughout Project	Through	Through	Through	DM 1231.04(1)
	Width Tangent Roadway	X	All Lines Throughout Project	N/A	11-ft min	14-ft min	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements, Route Continuity
	Width Turning Roadway	X	ALines Throughout Project	12 to 16-ft	13-ft min	12 to 14-ft	DM Exhibit 1240-2a & 3a Meet WB-67 Turning Movement Requirements, Route Continuity
	Lane Reduction	X	N-Line (318+93)	N/A	700-ft min.	700-ft min.	DM 1210.05(1)(b)
	OTHER						
2. Median / Buffer	Median Width	N/A					
	Median Width Taper	X	A-Line (100+00)	N/A	Varies	~~750-ft min.~~	DM 1210.05(1)(b) & (c)
			B-Line (223+81)	N/A		640-ft min.	
	Buffer Width	N/A					
	OTHER						
3. Shoulder	Shoulder Width - Inside	X	All Lines Throughout Project	Varies	2-ft min.	4-ft min	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements
	Shoulder Width - Outside	X	All Lines Throughout Project	Varies	4-ft min.	8-ft min.	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements
	Shoulder Width Bus Only	N/A					
	Parking Lane Width	N/A					
	OTHER						
4. Streetside / Roadside Zone	Design Element Not Applicable						
5. Pedestrian Facility	Design Element Not Applicable						
6. Bicycle Facility	Design Element Not Applicable						
7. Bridges	Lane Type	X	N-Line (307+84 to 310+47)	N/A	Through	Through	DM 1231.04(1)
	Width Tangent Roadway	X	N-Line (307+84 to 310+47)	N/A	11-ft min	14-ft min.	DM Exhibit 1360-6 Route Continuity & Freight Traffic
	Width Turning Roadway	X	N-Line (307+84 to 310+47)	N/A	13-ft min	14-ft min.	DM Exhibit 1240-2a & 3a Route Continuity & Freight Traffic
	Shoulder Width - Inside	X	N-Line (307+84 to 310+47)	N/A	2-ft min	4-ft min.	DM Exhibit 1360-6 Route Continuity & Freight Traffic
	Shoulder Width - Outside	X	N-Line (307+84 to 310+47)	N/A	4-ft min	8-ft min.	DM Exhibit 1360-6 Route Continuity, Freight Traffic, & Bike/Ped Safety
	Bridge Vertical Clearance	X	N-Line (307+84 to 310+47)	N/A	18.5-ft min	18.5-ft min	DM 720.03(5)(b)(1)
	Structural Capacity	X	N-Line (307+84 to 310+47)	N/A	LRFD HL-93	LRFD HL-93	DM 720.03(1)(a)
	Bridge Rail	X	N-Line (307+84 to 310+47)	N/A	2-ft 8-in min	3-ft 8-in min	DM 1610.07 Route Continuity, Freight Traffic, & Bike/Ped Safety
	Bridge Approach Slab	X	N-Line (307+84 to 310+47)	N/A	25-ft min	25-ft min	DM 720.03(8) & BDM
	Protective Screening	N/A					
	OTHER						

N/A

A Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
8. Horizontal Alignment	Stopping Sight Distance	X	A & B-Lines Throughout Project	N/A	155-ft min	155-ft min ✓	DM Exhibit 1260-1
			C-Line Throughout Project	155-ft min	155-ft min	155-ft min	
			N-Line Throughout Project	425-ft min	425-ft min	425-ft min	
	Passing Sight Distance	N/A					
	Decision Sight Distance	N/A					
	Curve Lengths	X	A-Line Throughout Project	N/A	500-ft desirable	~~368 to 785-ft~~	DM 1210.02(3) Meet WB-67 Turning Movement Requirements
			B-Line Throughout Project	N/A		221 to 983-ft	
			C-Line Throughout Project	200 to 936-ft		152 to 925-ft	
			N-Line Throughout Project	301 to 1003-ft		178 to 785-ft	
	Horizontal Curve Radii	X	A-Line Throughout Project	N/A	130 to 700-ft min	~~150 (25 mph)* to 1330-ft (50 mph)*~~	DM Exhibit 1250-4a 10% Max Superelevation Table *Meet WB-67 Turning Movement Requirements **Metch Exieting Super
			B-Line Throughout Project	N/A	130 to 700-ft min	145 (25 mph)* to 750-ft (50 mph)*	
			C-Line Throughout Project	225 to 1000-ft	130-ft min	220 to 900-ft * (25 mph)	
			N-Line Throughout Project	750 to 2749-ft	700-ft min	725 to 3000-ft *,**	
	Max. Defl. Angle w/o Curve	N/A					
	Lane Balance	N/A					
	Climbing Lanes	N/A					
	Spacing betw. Interchanges	N/A					
	Spacing betw. Ramp Noses	X	A-Line (L 412+26 to A 107+54)	N/A	600-ft min	600-ft min. ✓	DM Exhibit 1360-3
	Lane Width Transition	X	C-Line (90+77 to 93+84)	N/A	25:1 taper	25:1 taper min.	DM 1210.05 (1)(a) Meet WB-67 Turning Movement Requirements
	Increase Number of Lanes	N/A					
	Channelization Taper - Left	N/A					
	Channelization Taper - Right	N/A					
	U-turn width (List any elemants changed - See Chapter 1310)	N/A					
	Curbs on High Speed Road	N/A					
9. Vertical Alignment	Stopping Sight Distance	X	A-Line Throughout Project	N/A	155-ft min	155-ft min ✓	DM Exhibit 1260-1
			B-Line Throughout Project	N/A	155-ft min	155-ft min	
			C-Line Throughout Project	155-ft min	155-ft min	155-ft min	
			N-Line Throughout Project	425-ft min	425-ft min	425-ft min	
	Decision Sight Distance	N/A					
	Passing Sight Distance	N/A					
	Minimum Grade	X	A-Line Throughout Project ✓	N/A	To meet drainage requirements. Ditch gradient independant of roadway grade if necessary	To meet drainage ✓ requirements. Ditch gradient Independent of roadwey grede if necessary	DM 1220.02(4)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	Varies			
			N-Line Throughout Project	Varies			
	Length of Grade	X	A-Line Throughout Project ✓	N/A	1100-ft max	<1100-ft max. ✓	DM 1220.02(5)
			B-Line Throughout Project	N/A	950-ft max	<950-ft mex	
			C-Line Throughout Project	Varies	900-ft max	<900-ft mex	
			N-Line Throughout Project	Varies	3000-ft max	<3000-ft max	
	Vertical Curve Length	X	A-Line Throughout Project	N/A	75-ft min	>75-ft min ✓	DM Exhibit 1260-1
			B-Line Throughout Project	N/A	75-ft min	75-ft min	
			C-Line Throughout Project	Varies	75-ft min	75-ft min	
			N-Line Throughout Project	Varies	150-ft min	>150-ft min	
	Maximum Grade	X	A-Line Throughout Project	~~N/A~~	~~5% max~~	~~<5% max~~	DM Exhibit 1360-5
			B-Line Throughout Project	N/A	5% max	5% max	
			C-Line Throughout Project	Varies	7% mex	<7% mex	
			N-Line Throughout Project	Varies	3% max	<3% max	

194' min

150 min

DM ~~DESIGN~~ PROP.
7% max <7% max

A Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
10. Cross Slope	Cross Slope Lane	X	A-Line Throughout Project	N/A	2% min.	2% min.	DM 1250.02(1)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	2%			
			N-Line Throughout Project	2%			
	Cross Slope Shoulder	X	A-Line Throughout Project	N/A	2% min.	2% min.	DM 1250.02(2)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	2%			
			N-Line Throughout Project	2%			
	Cross Slope Grade Differential	N/A					
	Superelevation	X	A-Line Throughout Project	N/A	10% max	10% max	DM Exhibit 1250-4a
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	Varies			
			N-Line Throughout Project	Varies			
	Super Transition / Runoff	X	A-Line Throughout Project	N/A	Varies	Varies	DM Exhibit 1250-7b
			B-Line Throughout Project	N/A	85-ft min. (25 mph, 10% Super)	>85-ft min.	DM Exhibit 1250-7a & 7b Transition pivot point from edge of roadway to center at station 204+28.95
			C-Line Throughout Project	Varies			DM Exhibit 1250-7b
			N-Line Throughout Project	Varies			DM Exhibit 1250-7b
	OTHER						
11. Side Slope	Fill Slope	X	All Lines Throughout Project	2:1 max	2:1 max	~~2:1 max~~	~~DM 1600.03(1)(a)~~
	Ditch In-Slope	N/A					
	Ditch Back Slope	NA					
	Cut Slope	X	All Lines Throughout Project	2:1 max	2:1 max	2:1 max	DM 1600.03(1)(b)
	OTHER						
12. Clear Zone	Clear Zone	X	All Lines Throughout Project	Varies	Varies	Varies	DM Exhibit 1600-2 & 1600-5
	OTHER						
13. Barrier, Guardrail & Rumble Strips	Standard Run	X	A-Line Throughout Project	N/A	Beam Guardrail Type 31 & Concrete Barrier	Beam Guardrail Type 31 & Concrete Barrier	DM 1610.03(5)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	Beam Guardrail Type 1			
			N-Line Throughout Project	Beam Guardrail Type 1 & Concrete Barrier			
	Height	X	A-Line Throughout Project	N/A	Guardrail: 31-in min Barrier: 2-ft 8-in min	Guardrail: 31-in min Barrier: 3-ft 6-in min	Guardrail: DM 1610.04(1)(a) Barrier: DM 1610.06(2) Sight Distance, Route Continuity, Freight Traffic, & Bike/Ped Safety
			B-Line Throughout Project	N/A		Barrier: 2-ft 8-in min	
			C-Line Throughout Project	Guardrail: 28-in		Barrier: 3-ft 8-in min	
			N-Line Throughout Project	Guardrail: 28-in Barrier: 2-ft 8-in		Barrier: 3-ft 8-in min	
	Shy Distance	N/A					
	Transition Section	X	All Lines Throughout Project	N/A	Type 21	Type 21	DM Exhibit 1610-13
	End Treatment	X	All Lines Throughout Project	N/A	Non-flared terminal, TL-2 or TL-3	Non-flared terminal	DM 1610.04(5)(b)
	Rumble Strips	N/A					
	OTHER						

STET 4:1 Max

A Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
14. Signals, Illumination, and ITS	Signals	N/A					
	Illumination	X	A-Line Off-ramp gore area	N/A	N/A	Provide illumination at off-ramp gore area ✓	DM 1040.04(1)
			B-Line On-ramp gore eree	N/A	N/A	Provide illumination at on-ramp acceleration area	
			C-Lina Loop remp	N/A	N/A	Provide illumination where alignment is complex	
	ITS	X	A-Line (115+00)	N/A	N/A	Camera ✓	DM 1050
	Vertical Clearance	N/A					
	OTHER						
15. Signing and Delineation	Signing	X	All Lines Throughout Project	See attached	See Region Policy	See attached	DM 1020
	Delineation	X	All Lines Throughout Project	See attached	See Region Policy	See attached	DM 1030
	Vertical Clearance	N/A					
	OTHER						
16. On/Off Connections	On/Off Connection Type	X	A-Line (100+00)	N/A	Single-Lane, Tapered	Single-Lane, Tapered	DM 1360.04(5)(c)
	Acceleration length	X	B-Line (200+27)	N/A	1140-ft min	1140-ft min.	DM Exhibit 1360-9
	Deceleration Length	X	A-Line (100+00)	N/A	~~500-ft min~~	~~500-ft min~~	DM Exhibit 1360-10
			C-Line (80+00)	460-ft min	460-ft min	460-ft min	
	Ramp / Mainline Taper	X	A-Lina (100+00)	N/A	15:1 min 20:1 desirable	>20:1 desirable	DM Exhibit 1360-14a
	Gap Acceptance	N/A					
	Transition curve	N/A					
	Enforcement Area	N/A					
	Ramp Meter Storage	N/A					
	Weave	N/A					
	Gore Area	X	A-Line (107+54)	N/A	Varies	Varies	DM Exhibit 1360-11a
	Reserve Area Length	N/A					
	Reserve Area Taper	N/A					
	OTHER						
17. Intersection / Ramp Terminal	Right Turn Radius	N/A					
	Left Turn Radius	X	B-Line (200+07.37)	N/A	Verify by turn simulation	85-ft	DM 1310.03(2)(a)0-6 Meet WB-67 Turning Movement Requirements
	Intersection Angle	X	B-Line (200+07.37)	N/A	60° to 120°	60° min	DM 1310.02(2)0-6 Meet WB-67 Turning Movement Requirements
	Intersection Sight Distance	N/A					
	Left Turn Clearance	N/A					
	Lane Alignment	N/A					
	OTHER						
18. Road Approaches	Design Element Not Applicable						
19. Roundabout	Design Element Not Applicable						
20. Access	Design Element Not Applicable						

DM ~~Design~~ 460 ft min.

PROP >460 ft min.

Appendix E

Consideration for the Existing Intersection Justification Report

Executive Summary

Once selected as the project alignments, Hamilton-Lochner will prepare an amendment to the IJR as required to note and quantify variations in Policy Points specifically identified in the February 12, 2012 report. For concept approval, the following summary of effected policy points is provided:

Policy Point (1) Need for Access Point Revision

The project description identifies the movements being addressed

> *"...are SB Main St. to WB 1-82 and EB 1-82 to NB Main St…Making the missing movements available (EB 1-82 to NB Main and SB Main to WB 1-82) will help provide a direct route to the Yakima Regional Airport, as well as access to multiple commercial and residential areas for development, which is a regional priority."*

The alternative concept layout complies with the project description by providing these two movements.

Policy Point (2) Reasonable Alternatives

This policy point noted the only build alternative moving forward was designated "Alternative B" in which "*no existing ramps are altered, two ramps are added, along with a roundabout*"

The alternative concept shifts one existing ramp, adds two ramps, but does not provide a roundabout as that is part of a future Union Gap Beltway Project. The ATC layout provides minimal impact while providing improved traffic mobility in this build alternative.

Policy Point 3 Operations and Collision Analysis

At this time a full Traffic Safety Analysis has not been performed, however the alternative concept can still be shown to improve operations and reduce expected collisions. By eliminating the B line terminal (as defined in the SUG Traffic Analysis from June 2018) the alternative concept removes the one conflict point in the interchange such that paths of travel do not now cross. By eliminating the left turn from main Street to the WB82 ramp, the expected collisions and fatals reduces to ZERO.

A Traffic Safety Analysis for the entire interchange will be performed and submitted along with the Proposal, however based on the reduction of conflict points, elimination of the fatals and injury collisions at the B/M intersection, and expected overall reduction in ramp lengths the operations and collision analysis for this alternative will further prove a betterment.

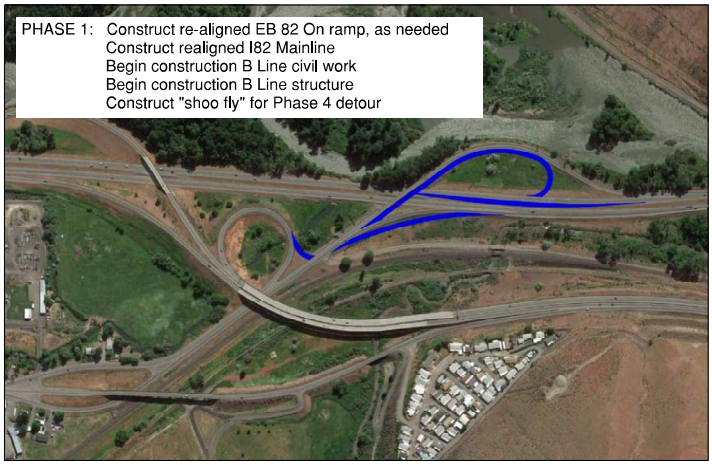
Policy Point (4) Access Connections and Designs

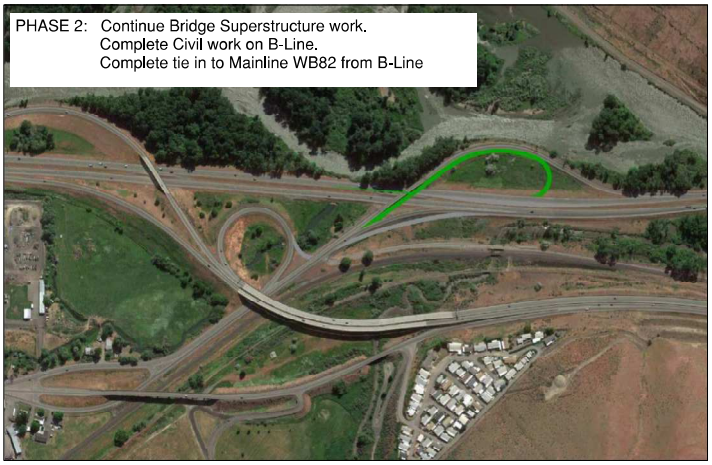
This policy point notes "*Each alternative either connects to an existing ramp and leaves the existing access point locations or*
adjusts the existing access point locations."

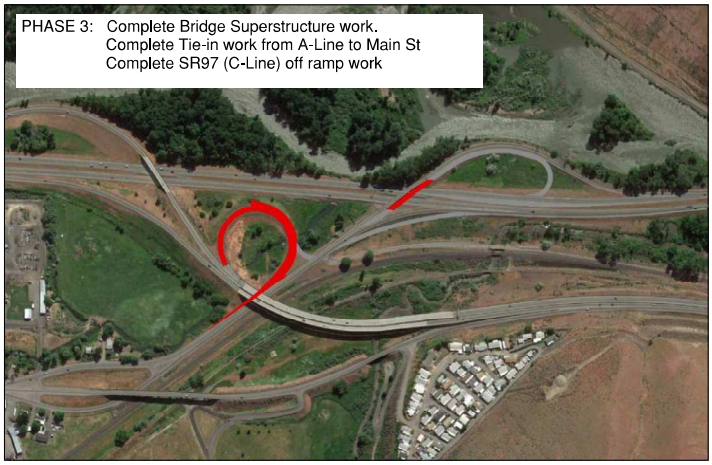
The alternative concept will create an additional access point onto WB82. The IJR will be updated accordingly.

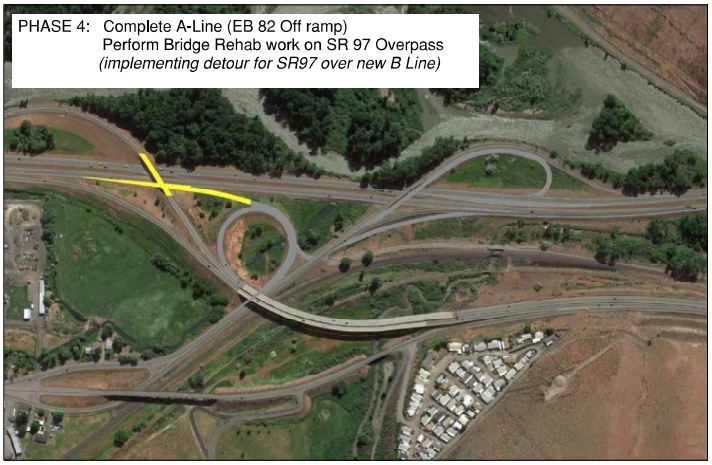
Policy Points 5 – 8 need not be addressed or revised.

Appendix F


PHASE 1: Construct re-aligned EB 82 On ramp, as needed
Construct realigned I82 Mainline
Begin construction B Line civil work
Begin construction B Line structure
Construct "shoo fly" for Phase 4 detour


PHASE 2: Continue Bridge Superstructure work.
Complete Civil work on B-Line.
Complete tie in to Mainline WB82 from B-Line


PHASE 3: Complete Bridge Superstructure work.
Complete Tie-in work from A-Line to Main St
Complete SR97 (C-Line) off ramp work


PHASE 4: Complete A-Line (EB 82 Off ramp)
Perform Bridge Rehab work on SR 97 Overpass
(implementing detour for SR97 over new B Line)

Appendix G - WSDOT Conceptual A-Line

Crash Severity Distribution (during Study Period)					A Line		
Fatal crash frequency ($N^*_{e,w,x,at,K}$), crashes:		0.254	0.319	0.303	0.114	0.116	
Incapacitating injury crash freq. ($N^*_{e,w,x,at,A}$), crashes:		0.770	0.968	0.918	0.345	0.352	
Non-incapacitating inj. crash freq. ($N^*_{e,w,x,at,B}$), crashes:		3.238	4.127	5.964	1.479	2.347	
Possible injury crash freq. ($N^*_{e,w,x,at,C}$), crashes:		4.335	6.251	8.678	2.344	4.267	
Total fatal-and-injury crash freq. ($N^*_{e,w,x,at,fi}$), crashes:		8.597	11.666	15.863	4.282	7.082	
Property-damage-only crash freq. ($N^*_{e,w,x,at,pdo}$), crashes:		9.999	17.993	23.965	5.376	9.917	
Total crash frequency ($N^*_{e,w,x,at,as}$), crashes:		18.596	29.659	39.828	9.657	17.000	
Intermediate Results							
Friction-limited curve speed for curve 1 ($v_{max,1}$), ft/s:		80.7	55.4	76.9	79.4	46.9	
Curve entry speed for curve 1 ($v_{ent,1}$), ft/s:		72.0	88.2	51.7	79.2	44.7	
Curve exit speed for curve 1 ($v_{ext,1}$), ft/s:		44.1	55.4	66.6	52.3	46.9	
Proportion of segment length with curve 1 ($P_{c,1}$):		0.457	0.136	0.111	0.455	0.273	
Friction-limited curve speed for curve 2 ($v_{max,2}$), ft/s:			46.3	66.9	41.3	40.9	
Curve entry speed for curve 2 ($v_{ent,2}$), ft/s:			55.4	83.5	44.1	56.6	
Curve exit speed for curve 2 ($v_{ext,2}$), ft/s:			44.1	66.9	44.1	40.9	
Proportion of segment length with curve 2 ($P_{c,2}$):			0.818	0.333	0.121	0.121	
Friction-limited curve speed for curve 3 ($v_{max,3}$), ft/s:			70.7	82.4		66.9	
Curve entry speed for curve 3 ($v_{ent,3}$), ft/s:			44.1	77.0		63.1	
Curve exit speed for curve 3 ($v_{ext,3}$), ft/s:			44.1	82.4		66.9	
Proportion of segment length with curve 3 ($P_{c,3}$):			0.045	0.111		0.212	
Friction-limited curve speed for curve 4 ($v_{max,4}$), ft/s:				101.4			
Curve entry speed for curve 4 ($v_{ent,4}$), ft/s:				82.4			
Curve exit speed for curve 4 ($v_{ext,4}$), ft/s:				88.2			
Proportion of segment length with curve 4 ($P_{c,4}$):				0.093			
Friction-limited curve speed for curve 5 ($v_{max,5}$), ft/s:							
Curve entry speed for curve 5 ($v_{ent,5}$), ft/s:							
Curve exit speed for curve 5 ($v_{ext,5}$), ft/s:							
Proportion of segment length with curve 5 ($P_{c,5}$):							
Distance from edge of right shoulder to barrier face (W_{rcb}), ft:		0.750	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the right side (P_{rb}):		0.429	0.273	0.667	0.848	0.970	
Distance from edge of left shoulder to barrier face (W_{lcb}), ft:		999.000	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the left side (P_{lb}):		0.000	0.727	0.148	0.364	0.879	
Proportion of segment length within a weaving section (P_{wev}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to speed-change lane of another ramp (P_{en-ex}):		0.257	0.591	0.000	0.000	0.000	
Proportion of segment length adjacent to taper of lane add or drop. (P_{tpr}):		0.000	0.000	0.000	0.000	0.000	
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or AADTc) by year, veh/d:	2020	12350	3930	13670	1780	1860	
	2021	12350	3930	13670	1780	1860	
	2022	12350	3930	13670	1780	1860	
	2023	12350	3930	13670	1780	1860	
	2024	12350	3930	13670	1780	1860	
	2025	12350	3930	13670	1780	1860	
	2026	12350	3930	13670	1780	1860	
	2027	12350	3930	13670	1780	1860	
	2028	12350	3930	13670	1780	1860	
	2029	12350	3930	13670	1780	1860	
	2030	12350	3930	13670	1780	1860	
	2031	12350	3930	13670	1780	1860	
	2032	12350	3930	13670	1780	1860	
	2033	12350	3930	13670	1780	1860	
	2034	12350	3930	13670	1780	1860	
	2035	12350	3930	13670	1780	1860	
	2036	12350	3930	13670	1780	1860	
	2037	12350	3930	13670	1780	1860	
	2038	12350	3930	13670	1780	1860	
	2039	12350	3930	13670	1780	1860	
	2040	12350	3930	13670	1780	1860	
	2041	12350	3930	13670	1780	1860	
	2042	12350	3930	13670	1780	1860	
	2043	12350	3930	13670	1780	1860	

Appendix G - Proposed ATC 01 A-Line

Crash Severity Distribution (during Study Period)		A Line					
Fatal crash frequency ($N^*_{e,w,x,at,K}$), crashes:		0.253	0.328	0.303	0.108	0.172	
Incapacitating injury crash freq. ($N^*_{e,w,x,at,A}$), crashes:		0.767	0.995	0.918	0.329	0.520	
Non-incapacitating inj. crash freq. ($N^*_{e,w,x,at,B}$), crashes:		3.223	4.271	5.964	1.386	3.438	
Possible injury crash freq. ($N^*_{e,w,x,at,C}$), crashes:		4.316	6.861	8.678	1.921	5.786	
Total fatal-and-injury crash freq. ($N^*_{e,w,x,at,fi}$), crashes:		8.560	12.455	15.863	3.745	9.916	
Property-damage-only crash freq. ($N^*_{e,w,x,at,pdo}$), crashes:		9.999	19.180	23.965	4.773	14.066	
Total crash frequency ($N^*_{e,w,x,at,as}$), crashes:		18.558	31.635	39.828	8.517	23.982	
Intermediate Results							
Friction-limited curve speed for curve 1 ($v_{max,1}$), ft/s:		80.7	55.4	76.9	89.6	61.0	
Curve entry speed for curve 1 ($v_{ent,1}$), ft/s:		72.0	88.2	51.7	64.9	72.0	
Curve exit speed for curve 1 ($v_{ext,1}$), ft/s:		44.1	55.4	66.6	55.9	61.0	
Proportion of segment length with curve 1 ($P_{c,1}$):		0.457	0.136	0.111	0.147	0.213	
Friction-limited curve speed for curve 2 ($v_{max,2}$), ft/s:			46.3	66.9	47.2	39.5	
Curve entry speed for curve 2 ($v_{ent,2}$), ft/s:			55.4	83.5	48.7	63.2	
Curve exit speed for curve 2 ($v_{ext,2}$), ft/s:			44.1	66.9	44.1	39.5	
Proportion of segment length with curve 2 ($P_{c,2}$):			0.818	0.333	0.265	0.128	
Friction-limited curve speed for curve 3 ($v_{max,3}$), ft/s:			70.7	82.4	50.0	101.5	
Curve entry speed for curve 3 ($v_{ent,3}$), ft/s:			44.1	77.0	44.1	39.5	
Curve exit speed for curve 3 ($v_{ext,3}$), ft/s:			44.1	82.4	44.1	52.0	
Proportion of segment length with curve 3 ($P_{c,3}$):			0.045	0.111	0.029	0.064	
Friction-limited curve speed for curve 4 ($v_{max,4}$), ft/s:				101.4		191.3	
Curve entry speed for curve 4 ($v_{ent,4}$), ft/s:				82.4		52.0	
Curve exit speed for curve 4 ($v_{ext,4}$), ft/s:				88.2		72.1	
Proportion of segment length with curve 4 ($P_{c,4}$):				0.093		0.191	
Friction-limited curve speed for curve 5 ($v_{max,5}$), ft/s:							
Curve entry speed for curve 5 ($v_{ent,5}$), ft/s:							
Curve exit speed for curve 5 ($v_{ext,5}$), ft/s:							
Proportion of segment length with curve 5 ($P_{c,5}$):							
Distance from edge of right shoulder to barrier face (W_{rcb}), ft:		0.750	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the right side (P_{rb}):		0.429	0.273	0.667	0.412	0.872	
Distance from edge of left shoulder to barrier face (W_{lcb}), ft:		999.000	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the left side (P_{lb}):		0.000	1.000	0.148	0.176	0.617	
Proportion of segment length within a weaving section (P_{wev}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to speed-change lane of another ramp (P_{en-ex}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to taper of lane add or drop. (P_{tpr}):		0.000	0.000	0.000	0.000	0.000	
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or AADTc) by year, veh/d:	2020	12350	3930	13670	1780	1860	
	2021	12350	3930	13670	1780	1860	
	2022	12350	3930	13670	1780	1860	
	2023	12350	3930	13670	1780	1860	
	2024	12350	3930	13670	1780	1860	
	2025	12350	3930	13670	1780	1860	
	2026	12350	3930	13670	1780	1860	
	2027	12350	3930	13670	1780	1860	
	2028	12350	3930	13670	1780	1860	
	2029	12350	3930	13670	1780	1860	
	2030	12350	3930	13670	1780	1860	
	2031	12350	3930	13670	1780	1860	
	2032	12350	3930	13670	1780	1860	
	2033	12350	3930	13670	1780	1860	
	2034	12350	3930	13670	1780	1860	
	2035	12350	3930	13670	1780	1860	
	2036	12350	3930	13670	1780	1860	
	2037	12350	3930	13670	1780	1860	
	2038	12350	3930	13670	1780	1860	
	2039	12350	3930	13670	1780	1860	
	2040	12350	3930	13670	1780	1860	
	2041	12350	3930	13670	1780	1860	
	2042	12350	3930	13670	1780	1860	
	2043	12350	3930	13670	1780	1860	

ATC 02, Rev 2:

Alternative 3 Interchange Configuration – B-Line

Washington State Department of Transportation

South Central Region
2809 Rudkin Road
Union Gap, WA 98903-1648
509-577-1600 / FAX: 509-577-1603
TTY: 1-800-833-6388
www.wsdot.wa.gov

October 3, 2018

Buck Allen
Hamilton Construction Company
1850 93rd Avenue SW
Olympia, WA 98512

RE: I-82 South Union Gap Interchange – Construct Ramps, ATC 02 Rev 2: Alternative 3 Interchange Configuration – B-Line

Mr. Allen:

WSDOT has reviewed Hamilton's **I-82 South Union Gap Interchange – Construct Ramps, ATC 02 Rev 2: Alternative 3 Interchange Configuration – B-Line**, as submitted on October 1, 2018. WSDOT's determination regarding this ATC is as follows:

The ATC is approved.

Please contact me if you have any questions.

Sincerely,

Bob Hooker, P.E.
Design Project Engineer

HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS

WSDOT

I-82, SOUTH UNION GAP INTERCHANGE - CONSTRUCT RAMPS

ATC 02 REV 2 : ALTERNATIVE 3 INTERCHANGE CONFIGURATION - B-LINE

HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS

Brief Description

ATC 01: Alternative 3 Interchange Configuration

Detailed Description

This ATC proposes to utilize an alternative configuration for the completion of the I-82 South Union Gap Interchange as previously presented as Alternative 3 Interchange Configuration (*see Appendix A)*. This ATC details the specific changes being proposed for the B-Line reconfiguration as they relate to the M1 Conceptual Plans. While requiring modifications to the RFP detailed below, this ATC meets the RFP requirement of "…constructing a westbound on-ramp from the City of Union Gap to I-82…" The alignment being proposed in this ATC provides WSDOT, stakeholders, local businesses and the traveling public with a number reduced impacts and benefits that are summarized below:

TABLE 1 – Proposed B-Line, Reduced Impacts & Benefits

Element	Proposed B-Line*	WSDOT Conceptual B-Line*
Floodplain Impact, Surf. Area (Impervious Area)	0 SY	7200 SY
Traffic Flow	1) Eliminates Left Turn Terminal/Conflict Point to the WB On-Ramp 2) Eliminates new traffic movements in the interchange with the existing NB US 97 to WB I-82 movement being maintained rather than shifted to a new alignment.	1) Includes Left Turn Terminal/Conflict Point to the WB On-Ramp 2) Adds a new traffic movement in the interchange with existing NB US 97 to WB I-82 traffic being shifted to a new alignment.
Roadway Design Criteria	Equal or Better (***See Appendix D***), Meets Roadway Design Criteria	Meets Roadway Design Criteria
Env. Permit Violation Risk, HVSF Needs	6100 LF of HVSF	7100 LF of HVSF
Road Excavation	4100 CY	13700 CY
CIP Retaining Walls	0 SF	460 SF
HMA	8000 TN	13500 TN
CSBC	3000 TN	12000 TN
Guardrail	2450 LF	2800 LF
Concrete Barrier	1250 LF	2250 LF

*All quantities other than Floodplain Impacts are approximate and include the net impact that utilizing the proposed B-Line will have on the B-Line, C-Line, N-Line,L-Line, (EB Only, No Impact on WB I-82) and the SB Main St to EB I-82 On-Ramp. ***Floodplain Impacts are specific to only the B-Line & N-Line.***

Additional information providing a detailed description of this ATC is contained in the ATC appendices. The various appendices are summarized in the table below and are referenced throughout the ATC:

TABLE 2 – ATC Appendices

Appendix	Description	Page Number
A	Alternative 3 Plan View	14
B	Plan/Profile/Roadway Section	15-16
C	PM Peak Traffic Volumes	17
D	Design Parameters Worksheet	18-21
E	Draft IJR Executive Summary & Policy Point Revisions	22-23
F	Impact Area Line Revisions	24-25
G	ISATe Crash Analysis	26-30

Usage

This ATC will be used to revise the B-Line alignment from the WSDOT M1 Conceptual Plan.

Subsurface Investigation

This ATC is based on existing WSDOT Geotechnical data within the interchange area including use of WSDOT borings for the existing bridges. Our geotechnical firm has reviewed the existing data and the existing borings are considered sufficient for preliminary design. A limited number of supplemental borings may be advanced during final design to confirm the existing data and the elevations of geologic units near planned foundation locations as refinement to the preliminary design.

Proposed RFP Modifications

Modify 1-01.3(1), as follows:

Basic Configuration – *The following required elements shown in the Conceptual Plans and/or Pre-Approved Design Analyses, as such elements may have been modified (with WSDOT's permission) in the Proposal:*

- *Number and width of proposed roadway lanes and shoulders*
  - *B-Line number of lanes will be maintained but tapers, widths and shoulders will be modified.* ***(Overall alignment has been realigned vertically and horizontally. All roadway geometry has been modified. See Appendix B and Appendix D for details)***

- *C-Line number of lanes will be maintained but tapers, widths and shoulders will be modified.* ***(C-Line existing roadway geometry will be maintained but concrete barrier will be added to help prevent rollover crashes.)***
- *L-Line number of lanes will be maintained but tapers, widths and shoulders will be modified. (****The Eastbound (EB) alignment will be modified with a lane shift in order to incorporate the merge from the proposed B-Line. See Appendix B for details. The Westbound (WB) alignment will not be modified.)***
- *M-Line number of lanes, widths and shoulders will be modified. (****The M-Line will be extended to the East to tie in with the conceptual B-Line location****).*
- *N-Line will be modified to maintain existing dimensions.* ***(With the proposed B-Line modification there will be no impact to the N-Line lanes, widths and shoulders.)***
- ***Appendix B (B-Line - Roadway Plan, Profile and Section) is supplemented by Appendix D (Design Parameters Worksheet).***

- *Type and location of guardrail*
  - *Guardrail location will be modified on the B-Line and M-Line as well as the modified Southbound (SB) Main St to EB I-82 alignment.*
- *Number and location of ITS equipment*
  - *Elements of the ITS requiring modification are noted above in "Location of new VMS, cameras, and Environmental Sensor System (ESS)"*
- *Project and ROW limits*
  - *The Project limits will be modified as the Impact Area Limits will be extended on the L-Line including the WB I-82 to Northbound (NB) Main St Off-Ramp, the M-Line and the SB Main St to EB I-82 On-Ramp.*
- *Limits of HMA paving****
  - *The project HMA paving limits will be modified on the B-Line, L-Line, M-Line, N-Line and modified EB Main St to EB I-82 Ramp. While the limits of paving will be adjusted, the roadway sections will be maintained as required in the RFP and M01 Conceptual Plans Roadway Sections (Sheets RS1 – RS5).*
- *Impact Area Line Segments that cut through Environmentally Sensitive Areas****
  - *The extension of the L-Line and WB I-82 to NB Main St Off-Ramp Impact Area Limits in order to build the proposed B-Line modification will result in the incorporation of a wetland into the Impact Area Limits.*

Modify 2.1.1.4, as follows:

Project Description ****The Project provides for the improvement of the existing South Union Gap interchange (Exit 37) by adding a new westbound on-ramp that includes a new bridge from Main St over I-82 and a new eastbound off ramp~~, and constructing a new bridge for US 97 over I-82~~. Other work includes, but is not limited to the following:*

- ~~*Realigning a section of US 97 that crosses over I-82*~~ *(Omit)*

Modify 2.7.3.2.6, as follow:

Planing Bituminous Pavement and HMA Overlay shall be constructed in the following locations:

****Of HMA, full width including shoulder, of the existing HMA remaining after construction on N, M, B and C Lines as follows:*

~~*N299+99.19 to N325+98.43*~~ *(Omit, New paving completed in 2016-2017 and our proposed B-Line modification results in no impact to the N-Line HMA)*

~~*B200+07.37 to B223+81.66*~~ *(Omit, With the proposed B-Line modification no existing B-Line HMA will remain)*

Modify 2.8.5.4.5, as follows:

Add:

2.8.5.4.5 Mitigation

- *This ATC will utilize WSDOT's regional existing wetland mitigation credits for a total of 0.38 acres of permanent wetland impacts.*
- *The Design-Builder can use the existing wetland mitigation credits but mitigation remains the sole responsibility of the Design-Builder, including any schedule cost risk.*
- *Any schedule or cost risk associated with obtaining revised permits, including project delays associated with this ATC, are the sole responsibility of the Design-Builder in accordance with Section 2.8.5.4.4 of Chapter 2 Technical Requirements.*
- *Design-Builder shall supply all information required by the regulatory agencies for the permit revisions. The Design-Builder shall document measures taken to avoid, minimize and mitigate wetland impacts. WSDOT will remain the point of contact for all permitting outlined in the RFP. The Design-Builder will be the point of contact for permitting that is outside of the scope of the RFP.*
- *During design and/or construction, if the Design-Builder exceeds acreage committed to in any approved ATC or combination of ATCs, the risk associated with mitigation, cost, and schedule is the sole responsibility of the Design-Builder. The Design-Builder shall initiate a change order to mitigate for additional permanent wetland impacts beyond 0.38 acres, at no additional cost or credit to WSDOT.*
- *Wetland impacts from the design and construction of the A-Line (either WSDOT Conceptual or proposed Hamilton ATC 01) will be eliminated through the utilization of a steeper slope at toe of fill and/or standard geosythetic retaining walls to minimize the roadway footprint.*

Modify 2.13.1, as follows:

General

The Design-Builder shall perform all Work necessary to complete the bridges and structures for the Project. Elements of Work shall include, at a minimum, the following:

- *Design and construct a new southbound Main St bridge (Bridge No.XX/XXXX) ~~northbound US 97 bridge (Bridge No.97/145W)~~ to convey traffic traveling along Main St ~~US 97~~ to westbound I-82. This work includes, but not limited to the following; bridge approach slabs, bridge expansion joints, bridge median netting, curtain walls, retaining walls, wingwalls, traffic barriers, railings, pigmented sealers, conduit pipes, and concrete barrier transitions.*

Modify 2.13.1.1, as follows:

Forward Compatibility

****The new Bridge No.XX/XXXX ~~No.97/145W~~ shall be designed and constructed to enable a future third lane on the outside of both eastbound and westbound of I-82 that will accommodate 10-foot shoulder, as described in these Technical Requirements.*

Modify 2.13.4.1.3, as follows:

Existing Bridge Monitoring Criteria

The Design-Builder shall develop a monitoring program for the existing westbound I-82 to northbound Main St Bridge ~~US 97 northbound Ramp to I-82 Bridge (WSDOT Br. No.97/145E)~~.

Modify 2.13.4.1.9, as follows:

For bridge and buried structures, the Design-Builder shall use spread footings, pile supported spread footings, shafts, or cast-in-place concrete piles for permanent structures. (Design-Builder assumes use of a pile-supported spread footing is contingent upon meeting all bridge foundation design requirements in the Bridge Design Manual, including steel corrosion criteria.)

Modify 2.13.4.1.12, as follows,

Lines 27-29

The Design-Builder shall design and install bridge median netting between the existing WB I-82 Off-Ramp to NB Main St bridge ~~97/145E~~ and the new bridge XX/XXXX ~~97/145W~~ in accordance with the Mandatory Standards (Appendix B)

Modify 2.21.3, as follows:

Performance Requirements – See attached preliminary traffic analysis (*Appendix C*) on traffic volumes anticipated with the proposed Alternative 3 interchange configuration.

Design Analyses

No design deviations and associated design analyses are required for this ATC.

Analysis

a) Functionality

Utilizing the proposed B-Line Alternative 3 interchange configuration will result in equal or better functionality of the South Union Gap Interchange as shown in the Appendix M1 Conceptual Plans. See *Table 3* for further details.

Functionality as it relates to meeting roadway design requirements are illustrated in the attached Design Parameters Worksheet (*Appendix D*), which indicate the proposed B-Line as being equal or better. Additionally, see *Appendix E* for the Executive Summary highlighting the suggested Policy Points modifications that will be included in an Interchange Justification Report amendment, if determined to be required post-award.

TABLE 3 – Proposed B-Line, Equal of Better Functionality

Element	Proposed B-Line	WSDOT Conceptual B-Line
Traffic Flow – Left Turn Terminal / Conflict Points	Eliminates Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.	Includes Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.
Traffic Flow – New Movements	Eliminates new traffic movements in the interchange with the existing NB US 97 to WB I-82 movement being maintained rather than shifted to a new alignment.	Adds a new traffic movement in the interchange with existing NB US 97 to WB I-82 traffic being shifted to a new alignment.
Roadway Design Criteria	Equal or Better (***See Appendix D***), Meets Roadway Design Criteria	Meets Roadway Design Criteria
Construction Schedule –	Anticipated Substantial Completion in	Anticipated Substantial Completion

Overall Schedule	late August.	in late September.

Construction Schedule – Overall Schedule

Local residents and businesses as well the traveling public will have full utilization of the newly configured interchange a month sooner than with construction of the WSDOT Conceptual interchange configuration. This will result in minimizing impacts to the local and national freight industry during the critical fruit and hop harvests of late summer and early fall.

b) Structural Adequacy

This ATC will have no negative effects on the structural adequacy of the project.

c) Safety

TABLE 4 – Proposed Safety Analysis of the Proposed B-Line

Element	Proposed B-Line*	WSDOT Conceptual B-Line*
Floodplain Impact, Surf. Area (Impervious Area)	0 SY	7200 SY
Traffic Flow – Roadway Geometry	Eliminates Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.	Includes Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.
Traffic Flow – New Movements	Eliminates new traffic movements in the interchange with the existing NB US 97 to WB I-82 movement being maintained rather than shifted to a new alignment.	Adds a new traffic movement in the interchange with existing NB US 97 to WB I-82 traffic being shifted to a new alignment.
Roadway Design Criteria	Equal or Better (***See Appendix D***), Meets Roadway Design Criteria	Meets Roadway Design Criteria
Maintenance Impacts Reduced	2450 LF Guardrail 1250 LF Concrete Barrier 8000 SY HMA	2800 LF Guardrail 2250 LF Concrete Barrier 13500 SY HMA
Construction Schedule – Overall Schedule	Anticipated Substantial Completion in late August.	Anticipated Substantial Completion in late September.
Total Crash Frequency **	23.982 crashes/15 yr**	22.042 crashes/15 yr**
Fatal Injury Crash Freq. **	0.172 crashes/15 yr**	0.125 crashes/15 yr**
Incapacitating Injury Crash Frequency **	0.520 crashes/15 yr**	0.398 crashes/15 yr**

*All quantities other than Floodplain Impacts are approximate and include the net impact that utilizing the proposed B-Line will have on the B-Line, C-Line, N-Line,L-Line, (EB Only, No Impact on WB I-82) and the SB Main St to EB I-82 On-Ramp. ***Floodplain Impacts are specific to only the B-Line & N-Line.***

**ISATe Analysis Summary - Safety Analysis Summary

1) ***Elimination of the B-Line Left Turn Terminal (B Terminal) will reduce the crashes on Main Street by approximately 5.042 total crashes per 15 years, or 1 less crash every 3 years.***
2) The revision to the overall B alignment (B-Line and B terminal) has the potential to increase fatal crashes by an average of approximately 0.047 fatal crashes per 15-year period and serious injury crashes on average by approximately 0.112 crashes per 15 year period. This translates into a potential fatal crash every 319 years and a potential serious injury crash every 122 years.
3) The predictive analysis also estimates a potential average increase of 1.457 total crashes of all types per 15 years; or one additional crash every 10.3 years.

Although, the revised alignment shows the potential for an increase in all crash types, it is expected that the added ramp movements will reduce congestion and crashes at local intersections in Union Gap and Yakima including the Valley Mall Blvd Interchange and will likely offset this small increase. The eliminated floodplain impacts and increased traffic flow efficiencies additionally offset the negligible increase in crashes. Approximately 60% of all crashes will be property damage only crashes.

Reduced Impacts to 100-Year Floodplain

The utilization of the proposed B-Line will reduce floodplain impacts to 0 SY of new roadway. The shifted alignment completely eliminates floodplain impacts as the existing WB I-82 to NB Main St Off-Ramp is not within the FEMA designated 100-YR (or 500 YR) floodplain and additionally eliminates all floodplain impacts on the N-Line because to plan doesn't require any widening on that alignment.

Maintenance Safety

Guardrail, concrete barrier and asphalt surfaces generally require maintenance over time. Reducing quantities of items requiring maintenance reduces the potential safety impacts of maintenance crews being exposed to the traveling public and the traveling public to the distraction and safety hazard of maintenance crews on the roadway.

Schedule Reduction

The proposed B-Line modification will help in reducing the construction schedule by a full month. In limiting the construction duration, all safety risks related to construction near active roadways will also be reduced by a month. Additionally, with substantial completion taking place between late August and late September, any schedule reduction will minimize impacts to the heavy freight traffic during the annual fruit and hop harvest that takes place during this

timeframe. The interchange being fully functional in the ultimate configuration a month early is a significant safety benefit to all roadway users.

d) Comparison of Life Cycle Costs

Reduction in Elements Requiring Maintenance

Guardrail, concrete barrier and asphalt surfaces, amongst other items, generally require maintenance over time. Reducing quantities of items requiring maintenance reduces the long-term cost impact to WSDOT. See *Table 5* for details regarding the reduction of project elements requiring long-term maintenance.

TABLE 5 – Proposed B-Line Reduction in Elements Requiring Repair and Maintenance

Element	Proposed B-Line*	WSDOT Conceptual B-Line*
CIP Retaining Walls	0 SF	460 SF
HMA	8000 TN	13500 TN
CSBC	3000 TN	12000 TN
Guardrail	2450 LF	2800 LF
Concrete Barrier	1250 LF	2250 LF

*All quantities are approximate and include the net impact that utilizing the proposed B-Line will have on the B-Line, C-Line, N-Line, L-Line (EB Only, No Impact on WB I-82) and the SB Main St to EB I-82 On-Ramp.

WSDOT Project Oversight

In reducing the project duration by one month, Alternative 3 also reduces WSDOT project oversight and inspection needs by one month. This will reduce the associated oversight and inspection costs for the month of schedule reduction. As well as reducing WSDOT oversight and inspection costs, WSDOT management personnel will be able to fully engage project close-out a month earlier and be available for new assignments sooner, therefore aiding in streamlining South Central Region construction operations.

e) Aesthetics

All aesthetic treatments as well as roadside restoration requirements per the RFP and Appendix L will be incorporated into the proposed B-Line modifications.

f) Impacts on Construction Traffic

Schedule Reduction

The proposed B-Line modification will help reduce the construction schedule by a full month. In limiting the construction duration, all safety risks related to construction near active roadways will also be reduced by a month. Additionally, with substantial completion taking place

between late August and late September, any schedule reduction will minimize impacts to the heavy freight traffic during the annual fruit and hop harvest that takes place during this timeframe. The interchange being fully functional in the ultimate configuration a month early is a significant safety benefit to all roadway users.

g) Effect on Environmental Commitments

TABLE 6 – Proposed B-Line Reduction of Environmental Impacts

Element	Proposed B-Line*	WSDOT Conceptual B-Line*
Wetland Impact	0.38 AC	0.0 AC
100-YR Floodplain, SY of New Roadway/Impervious Surfaces	0 SY	7200 SY
HVSF Needs	6100 LF	7100 LF
Overall Schedule Reduction (Complete Interchange)**	Apprx 6 months	Apprx 7 months

All quantities other than Floodplain Impacts are approximate and include the net impact that utilizing the proposed B-Line will have on the B-Line, C-Line, N-Line,L-Line, (EB Only, No Impact on WB I-82) and the SB Main St to EB I-82 On-Ramp. ***Floodplain Impacts are specific to only the B-Line & N-Line.*

** Related to a reduced carbon footprint of the project

Mitigation of Wetland Impacts

The utilization of the proposed B-Line modification will increase impacts to environmentally sensitive areas, specifically the wetland located wholly within the existing WB I-82 to Main St Off-Ramp (See *Appendix B*). However, the proposed B-Line modification does result in other environmental impact reductions including 100-YR Floodplain impacts, impervious surface reduction and less silt fence which are all betterments. Despite the fact that the wetland impact increase is not a betterment to the project, the proposed B-Line modification provides WSDOT, stakeholders, local residents and businesses and the traveling public with numerous other betterments that outweigh the negative of a wetland impact within an existing Interstate Off-Ramp. For a summary of these betterments, please review *Tables 1, 3, 4, 5, and 6*. We also feel it is likely that our final design for the B-Line will result in less than the stated 0.38 ac of wetland impact; therefore there is opportunity to further decrease the wetland impact as the B-Line design is refined post-award. Lastly, it is understood that if the actual impact to the wetlands related to the proposed B-Line modification requires re-permitting beyond that which is understood to be handled by WSDOT (permitting and mitigation beyond 0.14 AC but less than 0.50 AC), any costs related to mitigation and schedule impacts and will be borne by the design-builder. See RFP 2.8.5.4.3 for additional details.

Reduced Carbon Footprint

Our Alternative 3 concept will dramatically reduce the carbon footprint for this project by:

1. Eliminating one month of construction operations and the carbon emissions from construction equipment.
2. Eliminating one month of traffic impacts and the carbon emissions from the traveling public being slowed down through the construction site.
3. Reducing quantities of construction materials that traditionally require significant trucking into and/or out of the project site such as concrete, HMA, construction aggregates (borrow, base course, backfill, bedding) and roadway excavation. See *Table 5* above for additional quantity reductions created with use of the proposed A-Line modification.
4. Reducing quantities of prefabricated construction materials such as guardrail, cable-barrier, TESC items and reinforcing steel (elimination of drilled shafts and significant reduction in retaining walls) further reduces trucking needs as well carbon footprint related to manufacturing processes.

h) Impacts to Surrounding and Adjacent Communities

The Alternative 3 interchange configuration will reduce the impacts to the surroundings and adjacent communities, as highlighted in *Table 7* below.

TABLE 7 – Traffic Flow Improvements

Element	Proposed B-Line	WSDOT Conceptual B-Line
Traffic Flow – Left Turn Terminal / Conflict Points	Eliminates Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.	Includes Left Turn Terminal/Conflict Point to the WB On-Ramp/Conceptual B-Line.
Traffic Flow – New Movements	Eliminates new traffic movements in the interchange with the existing NB US 97 to WB I-82 movement being maintained rather than shifted to a new alignment.	Adds a new traffic movement in the interchange with existing NB US 97 to WB I-82 traffic being shifted to a new alignment.

Schedule Reduction

Utilization of the proposed B-Line modification will help reduce the construction schedule on the project by one month, thus reducing all associated impacts to the surrounding and adjacent communities by one month, as well. The impacts that will be reduced by a full month include: construction traffic impacts including freight mobility, adjacent business access, noise impacts, visual distraction impacts, safety impacts, and environmental impacts.

i) Changes to Noise Walls

Preliminary analysis shows little increase in noise levels at the single-family homes off Main Street or receptors within Fullbright Mobile Home Park in comparison to the existing condition or WSDOT's Baseline configuration. It is not anticipated that the receptors would experience an appreciable noise increase over existing conditions (equal or greater than 10 dBA) if the proposed B-Line or the WSDOT M1 Conceptual B-Line was built.

j) Impacts on Utilities and Rail

The Alternative 3 interchange configuration will have no negative impacts on the utilities, ITS or illumination plan shown in the Appendix M1 Conceptual Plans or the RFP. There will be some minor revisions to plan details but all requirements will be maintained.

k) Discussion of Additional Right of Way or Easements Required

The Alternative 3 interchange configuration will not require additional Right-Of-Way or easements for construction.

Appendix A

250 0 250 500
SCALE IN FEET

SR 97/82 JOB NO.XXXX SHEET ___ OF ___

FILE NAME: I:\BLV\OPPORTUNITIES\000014415\03_LOI-SOQ-Proposal\05_Graphics\03_CADD\14415-ALTS-COMBINED-with google-aerial.dwg					
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DATE: July 30, 2018					FED.AID PROJ.NO. FAPNO
PLOTTED BY: nbateman				JOB NUMBER JobNo	
DESIGNED BY:				CONTRACT NO. ContNo	LOCATION NO. LOC
ENTERED BY:					
CHECKED BY:					
PROJ. ENGR. A. BUTTERS	DESCRIPTION	DATE	NO.		

CONCEPT DESIGN
NOT FOR CONSTRUCTION
DRAFT 07-30-2018

Washington State Department of Transportation
HAMILTON CONSTRUCTION COMPANY
CONTRACTORS & ENGINEERS
LOCHNER

I-82 / SR 97
UNION GAP
INTERCHANGE

ALTERNATIVE 3 - LOCHNER A

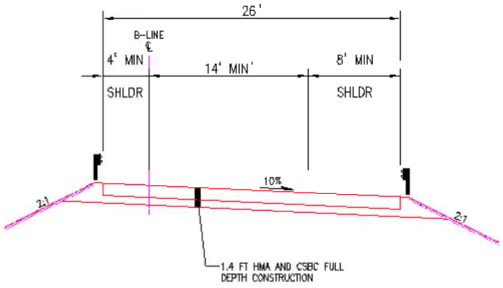
PLAN REF NO

SHEET OF SHEETS

Appendix B

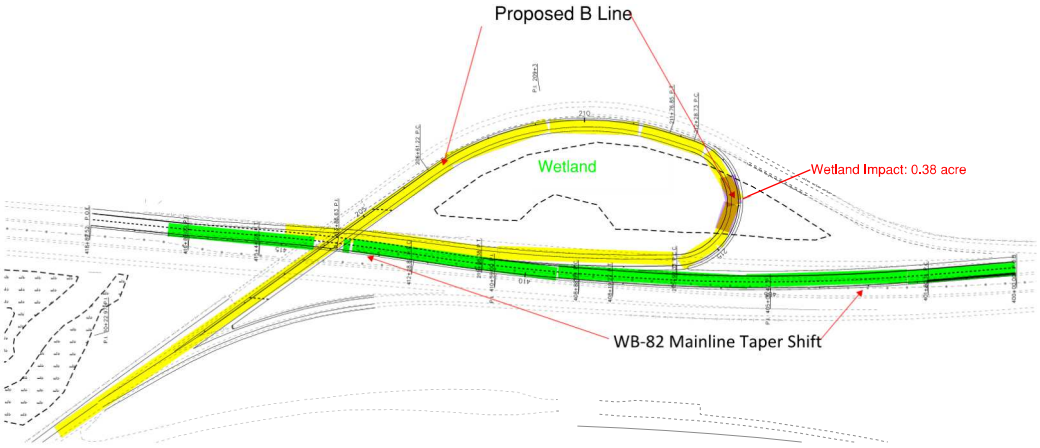
Alt 3, Proposed B-Line: *SB Main St to WB-82*

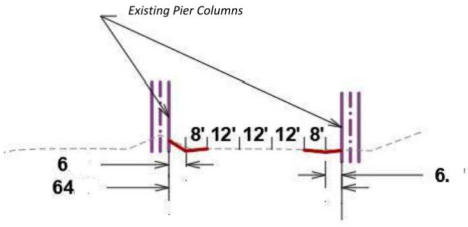
- Ramp curve Design speed: 25 mph
- Ramp tangent Design Speed: 50 mph
- Acceleration lane length : 644 ft
- Mainline Shift Rate to Median: 30 to 1 (24 ft in 700 ft)
- Maximum Lateral Taper Distance: 14 ft
- Mainline Taper rate from median: 33 to 1 (24 ft in 800 ft)
- Ramp Taper Rate: 67 to 1
- Stopping Sight Distance: 161ft (155' minimum, 25mph ramp, Exhibit 1260-1)



ROADWAY SECTION; B Line

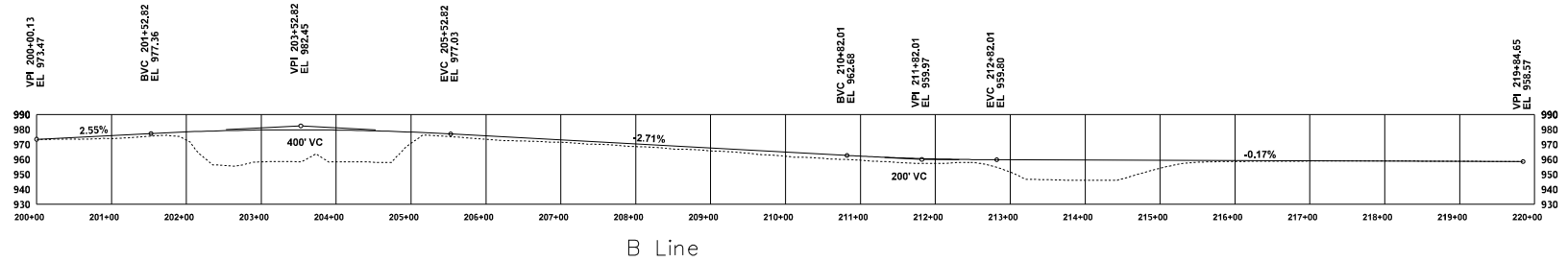
Guardrail shown but it is understood the concrete barrier is required along much of the proposed B-Line





WB-82 Mainline at Existing Overpass

(Traffic Barriers not shown, for clarity)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BVC 201+52.82
EL 977.36
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EVC 205+52.82
EL 977.03
BVC 210+82.01
EL 962.68
VPI 211+82.01
EL 959.97
EVC 212+82.01
EL 959.80
VPI 219+84.65
EL 958.57
2.55%
400' VC
-2.71%
200' VC
-0.17%
990
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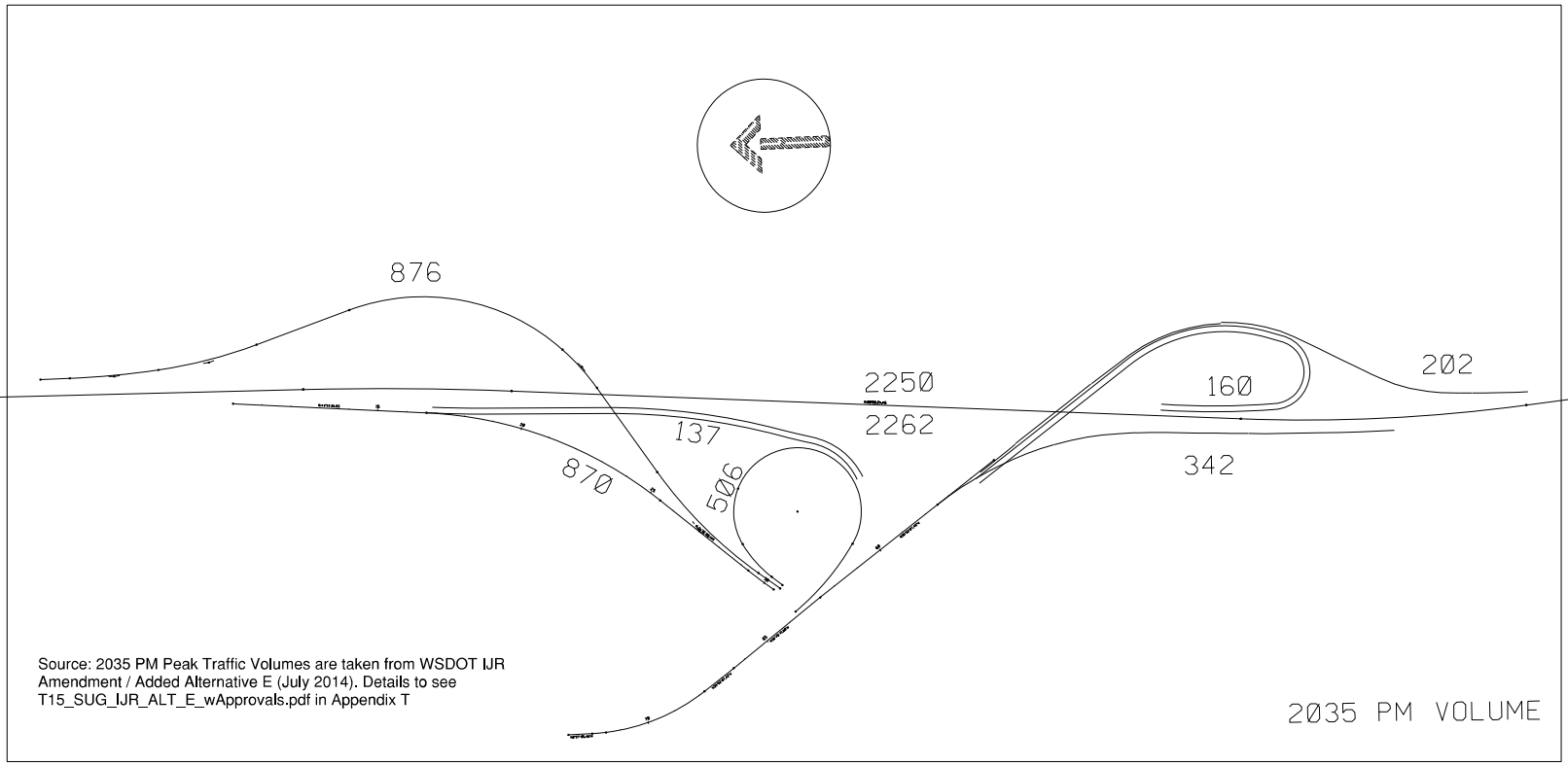
B Line

Appendix C


876
2250
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202
137
870
506
342
Source: 2035 PM Peak Traffic Volumes are taken from WSDOT IJR Amendment / Added Alternative E (July 2014). Details to see T15_SUG_IJR_ALT_E_wApprovals.pdf in Appendix T
2035 PM VOLUME

Appendix D - B-Line DPW

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
1. Lane	Number of Lanes	X	All Lines Throughout Project	1 Lane	1 to 2 Lanes	1 Lane ✓	DM Exhibit 1360-6
	Lane Type	X	All Lines Throughout Project	Through	Through	Through ✓	DM 1231.04(1)
	Width Tangent Roadway	X	All Lines Throughout Project	N/A	11-ft min	14-ft min ✓	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements, Route Continuity
	Width Turning Roadway	X	ALines Throughout Project	12 to 16-ft	13-ft min	12 to 14-ft ✓	DM Exhibit 1240-2a & 3a Meet WB-67 Turning Movement Requirements, Route Continuity
	Lane Reduction	X	N-Line (318+93)	N/A	700-ft min.	700-ft min.	DM 1210.05(1)(b)
	OTHER						
2. Median / Buffer	Median Width	N/A					
	Median Width Taper	X	A-Line (100+00)	N/A	Varies	750-ft min.	DM 1210.05(1)(b) & (c)
			B-Line (223+81)	N/A		~~840-ft min.~~	N/A
	Buffer Width	N/A					
	OTHER						
3. Shoulder	Shoulder Width - Inside	X	All Lines Throughout Project	Varies	2-ft min.	4-ft min	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements
	Shoulder Width - Outside	X	All Lines Throughout Project	Varies	4-ft min.	8-ft min.	DM Exhibit 1360-6 Meet WB-67 Turning Movement Requirements
	Shoulder Width Bus Only	N/A					
	Parking Lane Width	N/A					
	OTHER						
4. Streetside / Roadside Zone	Design Element Not Applicable						
5. Pedestrian Facility	Design Element Not Applicable						
6. Bicycle Facility	Design Element Not Applicable						
7. Bridges	Lane Type	X	~~N-Line (307+84 to 310+47)~~ B Line	N/A	Through	Through ✓	DM 1231.04(1)
	Width Tangent Roadway	X	~~N-Line (307+84 to 310+47)~~	N/A	11-ft min	14-ft min. ✓	DM Exhibit 1360-6 Route Continuity & Freight Traffic
	Width Turning Roadway	X	~~N-Line (307+84 to 310+47)~~	N/A	13-ft min	14-ft min. ✓	DM Exhibit 1240-2a & 3a Route Continuity & Freight Traffic
	Shoulder Width - Inside	X	~~N-Line (307+84 to 310+47)~~	N/A	2-ft min	4-ft min. ✓	DM Exhibit 1360-6 Route Continuity & Freight Traffic
	Shoulder Width - Outside	X	~~N-Line (307+84 to 310+47)~~	N/A	4-ft min	8-ft min. ✓	DM Exhibit 1360-6 Route Continuity, Freight Traffic, & Bike/Ped Safety
	Bridge Vertical Clearance	X	~~N-Line (307+84 to 310+47)~~	N/A	16.5-ft min	16.5-ft min ✓	DM 720.03(5)(b)(1)
	Structural Capacity	X	~~N-Line (307+84 to 310+47)~~	N/A	LRFD HL-93	LRFD HL-93	DM 720.03(1)(a)
	Bridge Rail	X	~~N-Line (307+84 to 310+47)~~	N/A	2-ft 8-in min	3-ft 6-in min	DM 1610.07 Route Continuity, Freight Traffic, & Bike/Ped Safety
	Bridge Approach Slab	X	~~N-Line (307+84 to 310+47)~~	N/A	25-ft min	25-ft min	DM 720.03(8) & BDM
	Protective Screening	N/A					
	OTHER						

B Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
8. Horizontal Alignment	Stopping Sight Distance	X	A & B-Lines Throughout Project	N/A	155-ft min	155-ft min ✓	DM Exhibit 1260-1
			C-Line Throughout Project	155-ft min	155-ft min	155-ft min	
			N-Line Throughout Project	425-ft min	425-ft min	425-ft min	
	Passing Sight Distance	N/A					
	Decision Sight Distance	N/A					
	Curve Length	X	A-Line Throughout Project	N/A	500-ft desirable	266 to 785-ft	DM 1210.02(3) Meet WB-67 Turning Movement Requirements
			B-Line Throughout Project	N/A		~~221 to 983-ft~~ *	
			C-Line Throughout Project	200 to 936-ft		152 to 925-ft	
			N-Line Throughout Project	301 to 1003-ft		178 to 785-ft	
	Horizontal Curve Radii	X	A-Line Throughout Project	N/A	130 to 700-ft min	150 (25 mph)* to 1330-ft (50 mph)*	DM Exhibit 1250-4a 10% Max Superelevation Table *Meet WB-67 Turning Movement Requirements **Match Existing Super
			B-Line Throughout Project	N/A	130 to 700-ft min	~~145 (25 mph)*~~ to 750-ft (50 mph)*	
			C-Line Throughout Project	225 to 1000-ft	130-ft min	220 to 900-ft * (25 mph)	
			N-Line Throughout Project	750 to 2749-ft	700-ft min	725 to 3000-ft *,**	
	Max. Defl. Angle w/o Curve	N/A					
	Lane Balance	N/A					
	Climbing Lanes	N/A					
	Spacing betw. Interchanges	N/A					
	Spacing betw. Ramp Noses	X	A-Line (L 412+26 to A 107+54)	N/A	800-ft min	800-ft min.	DM Exhibit 1360-3
	Lane Width Transition	X	C-Line (90+77 to 93+84)	N/A	25:1 taper	25:1 taper min.	DM 1210.05 (1)(a) Meet WB-67 Turning Movement Requirements
	Increase Number of Lanes	N/A					
	Channelization Taper - Left	N/A					
	Channelization Taper - Right	N/A					
	U-turn width (List any elements changed - See Chapter 1310)	N/A					
	Curbs on High Speed Road	N/A					
9. Vertical Alignment	Stopping Sight Distance	X	A-Line Throughout Project	N/A	155-ft min	155-ft min	DM Exhibit 1260-1
			B-Line Throughout Project	N/A	155-ft min	155-ft min ✓	
			C-Line Throughout Project	155-ft min	155-ft min	155-ft min	
			N-Line Throughout Project	425-ft min	425-ft min	425-ft min	
	Decision Sight Distance	N/A					
	Passing Sight Distance	N/A					
	Minimum Grade	X	A-Line Throughout Project	N/A	To meet drainage requirements. Ditch gradient independent of roadway grade if necessary	To meet drainage requirements. Ditch gradient independent of roadway grade if necessary ✓	DM 1220.02(4)
			B-Line Throughout Project ✓	N/A			
			C-Line Throughout Project	Varies			
			N-Line Throughout Project	Varies			
	Length of Grade	X	A-Line Throughout Project	N/A	1100-ft max	<1100-ft max.	DM 1220.02(5)
			B-Line Throughout Project	N/A	950-ft max	<950-ft max ✓	
			C-Line Throughout Project	Varies	900-ft max	<900-ft max	
			N-Line Throughout Project	Varies	3000-ft max	<3000-ft max	
	Vertical Curve Length	X	A-Line Throughout Project	N/A	75-ft min	>75-ft min	DM Exhibit 1260-1
			B-Line Throughout Project	N/A	75-ft min	75-ft min ✓	
			C-Line Throughout Project	Varies	75-ft min	75-ft min	
			N-Line Throughout Project	Varies	150-ft min	>150-ft min	
	Maximum Grade	X	A-Line Throughout Project	N/A	5% max	<5% max	DM Exhibit 1360-5
			B-Line Throughout Project	N/A	5% max	5% max ✓	
			C-Line Throughout Project	Varies	7% max	<7% max	
			N-Line Throughout Project	Varies	3% max	<3% max	

221 ft min

145 min

B Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
10. Cross Slope	Cross Slope Lane	X	A-Line Throughout Project	N/A	2% min.	2% min.	DM 1250.02(1)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	2%			
			N-Line Throughout Project	2%			
	Cross Slope Shoulder	X	A-Line Throughout Project	N/A	2% min.	2% min.	DM 1250.02(2)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	2%			
			N-Line Throughout Project	2%			
	Cross Slope Grade Differential	N/A					
	Superelevation	X	A-Line Throughout Project	N/A	10% max	10% max	DM Exhibit 1250-4a
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	Varies			
			N-Line Throughout Project	Varies			
	Super Transition / Runoff	X	A-Line Throughout Project	N/A	Varies	Varies	DM Exhibit 1250-7b
			B-Line Throughout Project	N/A	85-ft min. (25 mph,10% Super)	>85-ft min.	DM Exhibit 1250-7a & 7b Transition pivot point from edge of roadway to center at station 204+28.95
			C-Line Throughout Project	Varies			DM Exhibit 1250-7b
			N-Line Throughout Project	Varies			DM Exhibit 1250-7b
	OTHER						
11. Side Slope	Fill Slope	X	All Lines Throughout Project	2:1 max	2:1 max	~~2:1 max~~	DM 1600.03(1)(a) → 1.5:1 max
	Ditch In-Slope	N/A					
	Ditch Back Slope	NA					
	Cut Slope	X	All Lines Throughout Project	2:1 max	2:1 max	2:1 max	DM 1600.03(1)(b)
	OTHER						
12. Clear Zone	Clear Zone	X	All Lines Throughout Project	Varies	Varies	Varies	DM Exhibit 1600-2 & 1600-5
	OTHER						
13. Barrier, Guardrail & Rumble Strips	Standard Run	X	A-Line Throughout Project	N/A	Beam Guardrail Type 31 & Concrete Barrier	Beam Guardrail Type 31 & Concrete Barrier	DM 1610.03(5)
			B-Line Throughout Project	N/A			
			C-Line Throughout Project	Beam Guardrail Type 1			
			N-Line Throughout Project	Beam Guardrail Type 1 & Concrete Barrier			
	Height	X	A-Line Throughout Project	N/A	Guardrail: 31-in min Barrier: 2-ft 8-in min	Guardrail: 31-in min Barrier: 3-ft 6-in min	Guardrail: DM 1610.04(1)(a) Barrier: DM 1610.06(2) Sight Distance, Route Continuity, Freight Traffic, & Bike/Ped Safety
			B-Line Throughout Project	N/A		Barrier: 2-ft 8-in min	
			C-Line Throughout Project	Guardrail: 28-in		Barrier: 3-ft 6-in min	
			N-Line Throughout Project	Guardrail: 28-in Barrier: 2-ft 8-in		Barrier: 3-ft 6-in min	
	Shy Distance	N/A					
	Transition Section	X	All Lines Throughout Project	N/A	Type 21	Type 21	DM Exhibit 1610-13
	End Treatment	X	All Lines Throughout Project	N/A	Non-flared terminal, TL-2 or TL-3	Non-flared terminal	DM 1610.04(5)(b)
	Rumble Strips	N/A					
	OTHER						

B Line

General Design Elements	Detailed Design Elements (Parameters)	Changed Elements See Note 1	Physical Feature/Location	Existing Dimension	Design Manual Dimension	Proposed Dimension	Reference/Notes
14. Signals, Illumination, and ITS	Signals	N/A					
	Illumination	X	A-Line Off-ramp gore area	N/A	N/A	Provide illumination at off-ramp gore area	DM 1040.04(1)
			B-Line On-ramp gore area	N/A	N/A	Provide illumination at on-ramp acceleration area	
			C-Line Loop ramp	N/A	N/A	Provide illumination where alignment is complex	
	ITS	X	A-Line (115+00)	N/A	N/A	Camera	DM 1050
	Vertical Clearance	N/A					
	OTHER						
15. Signing and Delineation	Signing	X	All Lines Throughout Project	See attached	See Region Policy	See attached	DM 1020
	Delineation	X	All Lines Throughout Project	See attached	See Region Policy	See attached	DM 1030
	Vertical Clearance	N/A					
	OTHER						
16. On/Off Connections	On/Off Connection Type	X	A-Line (100+00)	N/A	Single-Lane, Tapered	Single-Lane, Tapered	DM 1360.04(5)(c)
	Acceleration length	X	B-Line (200+27)	N/A	~~1140-ft min~~	~~1140-ft min.~~	~~DM Exhibit 1360-9~~
	Deceleration Length	X	A-Line (100+00)	N/A	500-ft min	500-ft min	DM Exhibit 1360-10
			C-Line (80+00)	460-ft min	460-ft min	460-ft min	
	Ramp / Mainline Taper	X	A-Line (100+00)	N/A	15:1 min 20:1 desirable	>20:1 desirable	DM Exhibit 1360-14a
	Gap Acceptance	N/A					
	Transition curve	N/A					
	Enforcement Area	N/A					
	Ramp Meter Storage	N/A					
	Weave	N/A					
	Gore Area	X	A-Line (107+54)	N/A	Varies	Varies	DM Exhibit 1360-11a
	Reserve Area Length	N/A					
	Reserve Area Taper	N/A					
	OTHER						
17. Intersection / Ramp Terminal	Right Turn Radius	N/A					
	~~Left Turn Radius~~	~~X~~	~~B-Line (200+07.37)~~	~~N/A~~	Verify by turn simulation	55-ft	DM 1310.03(2)(a)0-6 Meet WB-67 Turning Movement Requirements
	~~Intersection Angle~~	~~X~~	~~B-Line (200+07.37)~~	~~N/A~~	60° to 120°	60° min	DM 1310.02(2)0-6 Meet WB-67 Turning Movement Requirements
	Intersection Sight Distance	N/A					
	Left Turn Clearance	N/A					
	Lane Alignment	N/A					
	OTHER						
18. Road Approaches	Design Element Not Applicable						
19. Roundabout	Design Element Not Applicable						
20. Access	Design Element Not Applicable						

DM 550' min

PROP > 550' min

TERMINAL ELIMINATED

Appendix E

Consideration for the Existing Intersection Justification Report

Executive Summary

Once selected as the project alignments, Hamilton-Lochner will prepare an amendment to the IJR as required to note and quantify variations in Policy Points specifically identified in the February 12, 2012 report. For concept approval, the following summary of effected policy points is provided:

Policy Point (1) Need for Access Point Revision

The project description identifies the movements being addressed

> *"...are SB Main St. to WB 1-82 and EB 1-82 to NB Main St…Making the missing movements available (EB 1-82 to NB Main and SB Main to WB 1-82) will help provide a direct route to the Yakima Regional Airport, as well as access to multiple commercial and residential areas for development, which is a regional priority."*

The alternative concept layout complies with the project description by providing these two movements.

Policy Point (2) Reasonable Alternatives

This policy point noted the only build alternative moving forward was designated "Alternative B" in which "*no existing ramps are altered, two ramps are added, along with a roundabout*"

The alternative concept shifts one existing ramp, adds two ramps, but does not provide a roundabout as that is part of a future Union Gap Beltway Project. The ATC layout provides minimal impact while providing improved traffic mobility in this build alternative.

Policy Point 3 Operations and Collision Analysis

At this time a full Traffic Safety Analysis has not been performed, however the alternative concept can still be shown to improve operations and reduce expected collisions. By eliminating the B line terminal (as defined in the SUG Traffic Analysis from June 2018) the alternative concept removes the one conflict point in the interchange such that paths of travel do not now cross. By eliminating the left turn from main Street to the WB82 ramp, the expected collisions and fatals reduces to ZERO.

A Traffic Safety Analysis for the entire interchange will be performed and submitted along with the Proposal, however based on the reduction of conflict points, elimination of the fatals and injury collisions at the B/M intersection, and expected overall reduction in ramp lengths the operations and collision analysis for this alternative will further prove a betterment.

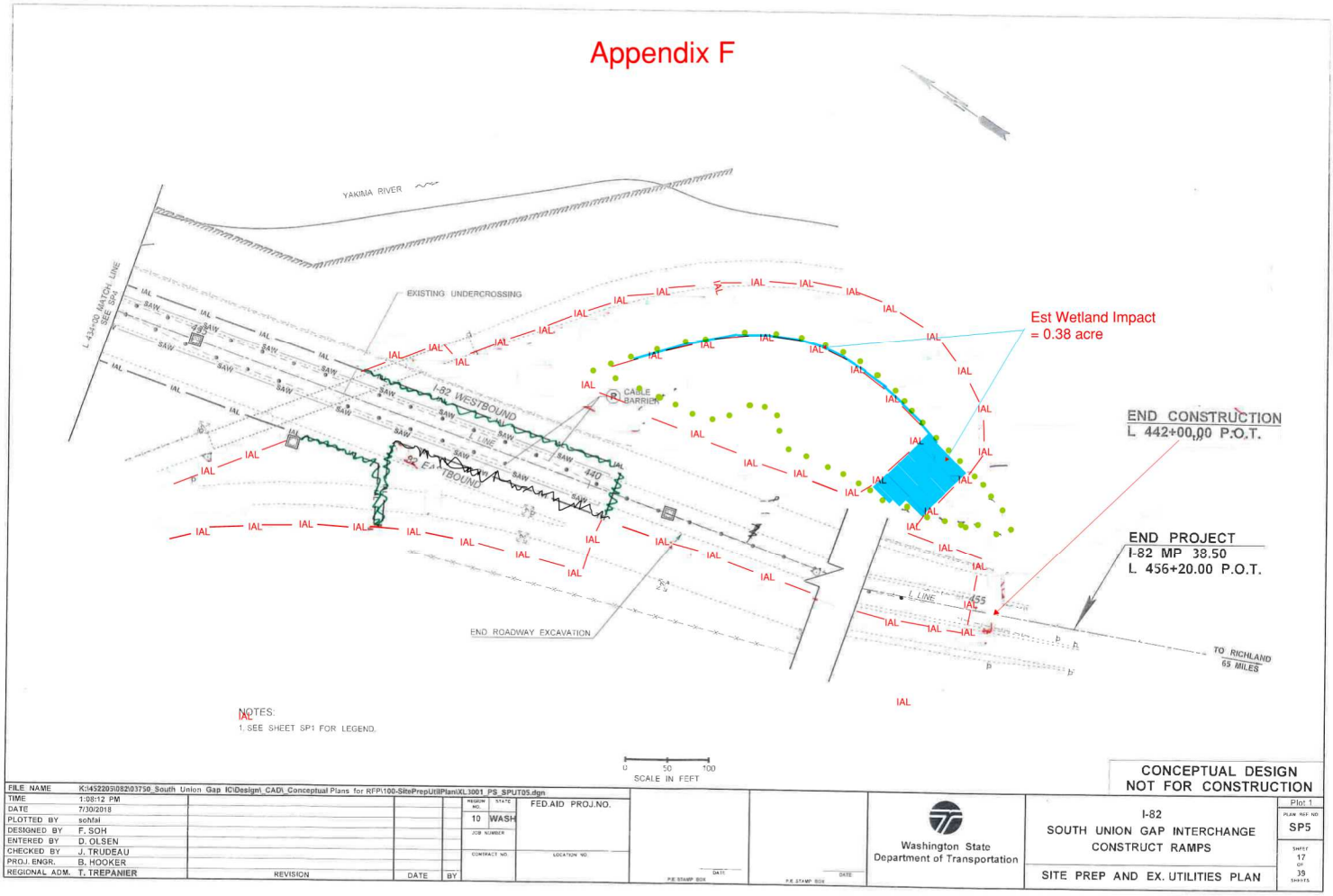
Policy Point (4) Access Connections and Designs

This policy point notes "*Each alternative either connects to an existing ramp and leaves the existing access point locations or*
adjusts the existing access point locations."

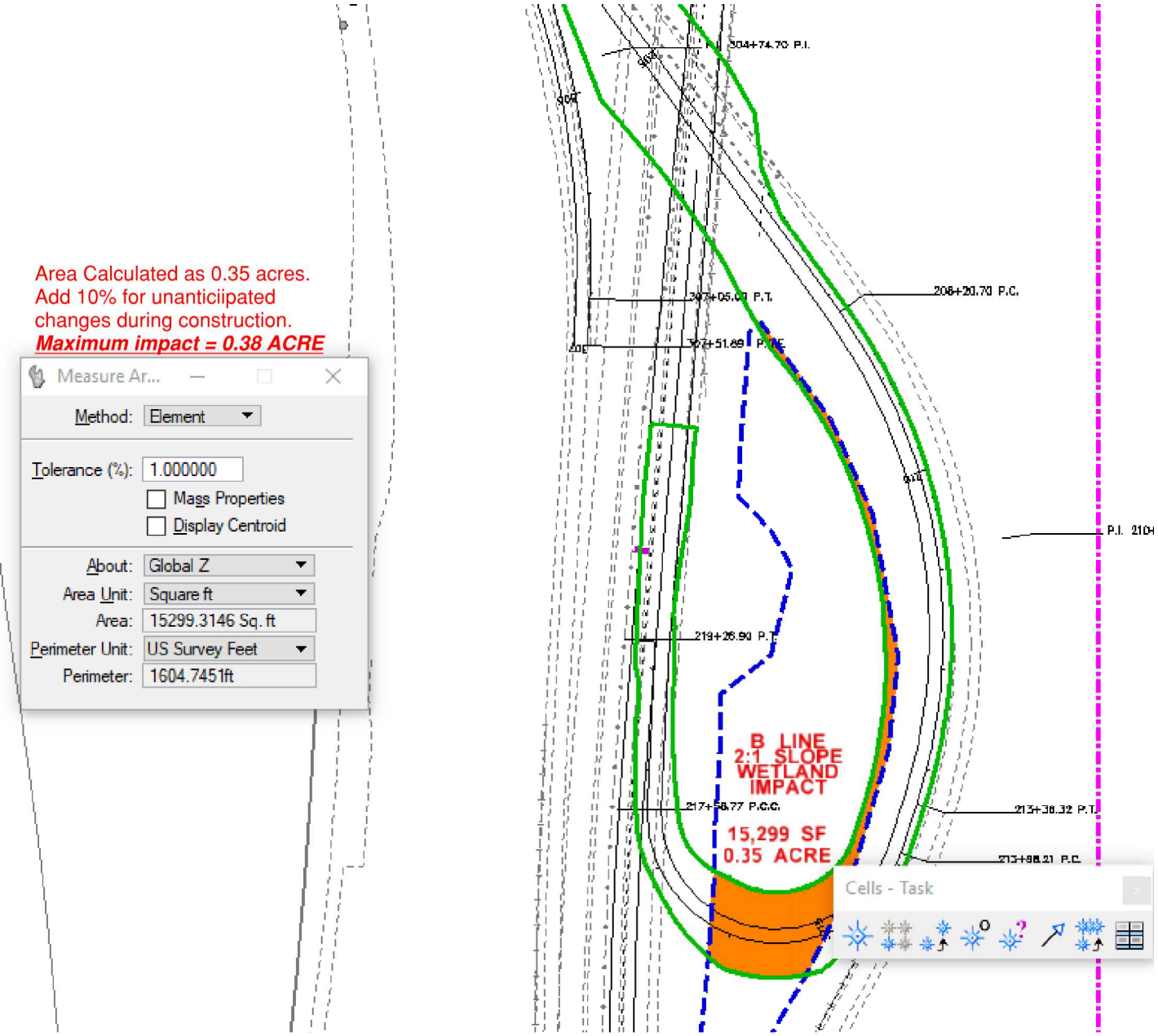
The alternative concept will create an additional access point onto WB82. The IJR will be updated accordingly.

Policy Points 5 – 8 need not be addressed or revised.

Appendix F


YAKIMA RIVER
EXISTING UNDERCROSSING
L 434+00 MATCH LINE SEE SP4
I-82 WESTBOUND
I-82 EASTBOUND
CABLE BARRIER
Est Wetland Impact
= 0.38 acre
END CONSTRUCTION
L 442+00.00 P.O.T.
END PROJECT
I-82 MP 38.50
L 456+20.00 P.O.T.
END ROADWAY EXCAVATION
TO RICHLAND
69 MILES
IAL
SAW
NOTES:
1. SEE SHEET SP1 FOR LEGEND.
0 50 100
SCALE IN FEET
CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION
FILE NAME K:\45220\108203750_South Union Gap IC\Design_CAD_Conceptual Plans for RFP\100-SitePrepUtilPlan\XL3001_PS_SPUT05.dgn
TIME 1:08:12 PM
DATE 7/30/2018
PLOTTED BY sohlal
DESIGNED BY F. SOH
ENTERED BY D. OLSEN
CHECKED BY J. TRUDEAU
PROJ. ENGR. B. HOOKER
REGIONAL ADM. T. TREPANIER
REVISION
DATE
BY
REGION NO. 10
STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX
DATE
Washington State Department of Transportation
I-82
SOUTH UNION GAP INTERCHANGE
CONSTRUCT RAMPS
SITE PREP AND EX. UTILITIES PLAN
Plot 1
PLAN REF NO SP5
SHEET 17 OF 35 SHEETS

Area Calculated as 0.35 acres.
Add 10% for unanticiipated changes during construction.
Maximum impact = 0.38 ACRE



Appendix G - Summary

	WSDOT			ATC			
	Ramp	Terminal	Combined	Ramp	Terminal	Combined	Difference
Fatal Crash Frequency	0.116	0.009	0.125	0.172	0	0.172	**0.047**
Incapacitating	0.352	0.046	0.398	0.52	0	0.520	**0.122**
Non-Incapacitating	2.347	0.298	2.645	3.438	0	3.438	0.793
Possible injury	4.267	1.303	5.57	5.786	0	5.786	0.216
Total fatal-and-injury	7.082	1.656	8.738	9.916	0	9.916	1.178
Property Damage Only	9.917	3.87	13.787	14.066	0	14.066	0.279
Total Crash Frequency	17.000	5.042	22.042	23.982	0	23.982	**1.94**

WSDOT Conceptual B-Line

Crash Severity Distribution (during Study Period)							
Fatal crash frequency ($N^*_{e,w,x,at,K}$), crashes:		0.254	0.319	0.303	0.114	0.116	
Incapacitating injury crash freq. ($N^*_{e,w,x,at,A}$), crashes:		0.770	0.968	0.918	0.345	0.352	
Non-incapacitating inj. crash freq. ($N^*_{e,w,x,at,B}$), crashes:		3.238	4.127	5.964	1.479	2.347	
Possible injury crash freq. ($N^*_{e,w,x,at,C}$), crashes:		4.335	6.251	8.678	2.344	4.267	
Total fatal-and-injury crash freq. ($N^*_{e,w,x,at,fi}$), crashes:		8.597	11.666	15.863	4.282	7.082	
Property-damage-only crash freq. ($N^*_{e,w,x,at,pdo}$), crashes:		9.999	17.993	23.965	5.376	9.917	
Total crash frequency ($N^*_{e,w,x,at,as}$), crashes:		18.596	29.659	39.828	9.657	17.000	
Intermediate Results							
Friction-limited curve speed for curve 1 ($v_{max,1}$), ft/s:		80.7	55.4	76.9	79.4	46.9	
Curve entry speed for curve 1 ($v_{ent,1}$), ft/s:		72.0	88.2	51.7	79.2	44.7	
Curve exit speed for curve 1 ($v_{ext,1}$), ft/s:		44.1	55.4	66.6	52.3	46.9	
Proportion of segment length with curve 1 ($P_{c,1}$):		0.457	0.136	0.111	0.455	0.273	
Friction-limited curve speed for curve 2 ($v_{max,2}$), ft/s:			46.3	66.9	41.3	40.9	
Curve entry speed for curve 2 ($v_{ent,2}$), ft/s:			55.4	83.5	44.1	56.6	
Curve exit speed for curve 2 ($v_{ext,2}$), ft/s:			44.1	66.9	44.1	40.9	
Proportion of segment length with curve 2 ($P_{c,2}$):			0.818	0.333	0.121	0.121	
Friction-limited curve speed for curve 3 ($v_{max,3}$), ft/s:			70.7	82.4		66.9	
Curve entry speed for curve 3 ($v_{ent,3}$), ft/s:			44.1	77.0		63.1	
Curve exit speed for curve 3 ($v_{ext,3}$), ft/s:			44.1	82.4		66.9	
Proportion of segment length with curve 3 ($P_{c,3}$):			0.045	0.111		0.212	
Friction-limited curve speed for curve 4 ($v_{max,4}$), ft/s:				101.4			
Curve entry speed for curve 4 ($v_{ent,4}$), ft/s:				82.4			
Curve exit speed for curve 4 ($v_{ext,4}$), ft/s:				88.2			
Proportion of segment length with curve 4 ($P_{c,4}$):				0.093			
Friction-limited curve speed for curve 5 ($v_{max,5}$), ft/s:							
Curve entry speed for curve 5 ($v_{ent,5}$), ft/s:							
Curve exit speed for curve 5 ($v_{ext,5}$), ft/s:							
Proportion of segment length with curve 5 ($P_{c,5}$):							
Distance from edge of right shoulder to barrier face (W_{rcb}), ft:		0.750	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the right side (P_{rb}):		0.429	0.273	0.667	0.848	0.970	
Distance from edge of left shoulder to barrier face (W_{lcb}), ft:		999.000	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the left side (P_{lb}):		0.000	0.727	0.148	0.364	0.879	
Proportion of segment length within a weaving section (P_{wev}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to speed-change lane of another ramp (P_{sa-ar}):		0.257	0.591	0.000	0.000	0.000	
Proportion of segment length adjacent to taper of lane add or drop, (P_{tpr}):		0.000	0.000	0.000	0.000	0.000	
Traffic Data	**Year**						
Average daily traffic (AADT, or AADTc) by year, veh/d:	2020	12350	3930	13670	1780	1860	
	2021	12350	3930	13670	1780	1860	
	2022	12350	3930	13670	1780	1860	
	2023	12350	3930	13670	1780	1860	
	2024	12350	3930	13670	1780	1860	
	2025	12350	3930	13670	1780	1860	
	2026	12350	3930	13670	1780	1860	
	2027	12350	3930	13670	1780	1860	
	2028	12350	3930	13670	1780	1860	
	2029	12350	3930	13670	1780	1860	
	2030	12350	3930	13670	1780	1860	
	2031	12350	3930	13670	1780	1860	
	2032	12350	3930	13670	1780	1860	
	2033	12350	3930	13670	1780	1860	
	2034	12350	3930	13670	1780	1860	
	2035	12350	3930	13670	1780	1860	
	2036	12350	3930	13670	1780	1860	
	2037	12350	3930	13670	1780	1860	
	2038	12350	3930	13670	1780	1860	
	2039	12350	3930	13670	1780	1860	
	2040	12350	3930	13670	1780	1860	
	2041	12350	3930	13670	1780	1860	
	2042	12350	3930	13670	1780	1860	
	2043	12350	3930	13670	1780	1860	

WSDOT Conceptual B-Line Terminal

Predicted Average Crash Frequency

Fatal-and-Injury Crash Frequency

Ramp Terminal Crash Analysis	Year		
Overdispersion parameter ($k_{w\,x\,at\,fi}$):			
Observed crash count ($N^*_{o\,w\,x\,at\,fi}$), crashes:			
Reference year (r):			
Predicted average crash freq. for reference year ($N_{p\,w\,x\,at\,fi\,r}$), crashes/yr:			
Equivalent years associated with crash count ($C_{b\,w\,x\,at\,fi\,r}$), yr:			
Expected average crash freq. for reference year given $N^*_{...}$ ($N_{...}$), crashes/yr			
Predicted average crash frequency ($N_{p\,w\,x\,at\,fi}$), crashes/yr:	2020	0.103	
	2021	0.103	
	2022	0.103	
	2023	0.103	
	2024	0.103	
	2025	0.103	
	2026	0.103	
	2027	0.103	
	2028	0.103	
	2029	0.103	
	2030	0.103	
	2031	0.103	
	2032	0.103	
	2033	0.103	
	2034	0.103	
	2035	0.103	
	2036		
	2037		
	2038		
	2039		
	2040		
	2041		
	2042		
	2043		

Property-Damage-Only Crash Frequency

Ramp Terminal Crash Analysis	Year		
Overdispersion parameter ($k_{w\,x\,at\,pdo}$):			
Observed crash count ($N^*_{o\,w\,x\,at\,pdo}$), crashes:			
Reference year (r):			
Predicted average crash freq. for reference year ($N_{p\,w\,x\,at\,pdo\,r}$), crashes/yr:			
Equivalent years associated with crash count ($C_{b\,w\,x\,at\,pdo\,r}$), yr:			
Expected average crash freq. for reference year given $N^*_{...}$ ($N_{...}$), crashes/yr:			
Predicted average crash frequency ($N_{p\,w,x\,at\,pdo}$), crashes/yr:	2020	0.212	
	2021	0.212	
	2022	0.212	
	2023	0.212	
	2024	0.212	
	2025	0.212	
	2026	0.212	
	2027	0.212	
	2028	0.212	
	2029	0.212	
	2030	0.212	
	2031	0.212	
	2032	0.212	
	2033	0.212	
	2034	0.212	
	2035	0.212	
	2036		
	2037		
	2038		
	2039		
	2040		
	2041		
	2042		
	2043		

Crash Severity Distribution (during Study Period)			
Fatal crash frequency ($N^*_{e\,w,x\,at,K}$), crashes:		0.009	
Incapacitating injury crash freq. ($N^*_{e\,w\,x,at,A}$), crashes:		0.046	
Non-incapacitating inj. crash freq. ($N^*_{e\,w\,x\,at\,B}$), crashes:		0.298	
Possible injury crash freq. ($N^*_{e\,w\,x\,at\,C}$), crashes:		1.303	
Total fatal-and-injury crash freq. ($N^*_{e\,w\,x\,at\,fi}$), crashes:		1.656	
Property-damage-only crash freq. ($N^*_{e\,w\,x\,at\,pdo}$), crashes:		3.387	
Total crash frequency ($N^*_{e\,w,x\,at\,as}$), crashes:		5.042	

Proposed ATC 02 B-Line

B

Crash Severity Distribution (during Study Period)							
Fatal crash frequency ($N^*_{e\,w\,x\,at\,K}$), crashes:		0.253	0.328	0.303	0.108	0.172	
Incapacitating injury crash freq. ($N^*_{e\,w\,x\,at\,A}$), crashes:		0.767	0.995	0.918	0.329	0.520	
Non-incapacitating inj. crash freq. ($N^*_{e\,w\,x\,at\,B}$), crashes:		3.223	4.271	5.964	1.386	3.438	
Possible injury crash freq. ($N^*_{e\,w\,x\,at\,C}$), crashes:		4.316	6.861	8.678	1.921	5.786	
Total fatal-and-injury crash freq. ($N^*_{e\,w\,x\,at\,fi}$), crashes:		8.560	12.455	15.863	3.745	9.916	
Property-damage-only crash freq. ($N^*_{e\,w\,x\,at\,pdo}$), crashes:		9.999	19.180	23.965	4.773	14.066	
Total crash frequency ($N^*_{e\,w\,x\,at\,as}$), crashes:		18.558	31.635	39.828	8.517	23.982	
Intermediate Results							
Friction-limited curve speed for curve 1 ($v_{max\,1}$), ft/s:		80.7	55.4	76.9	89.6	61.0	
Curve entry speed for curve 1 ($v_{ent\,1}$), ft/s:		72.0	88.2	51.7	64.9	72.0	
Curve exit speed for curve 1 ($v_{ext\,1}$), ft/s:		44.1	55.4	66.6	55.9	61.0	
Proportion of segment length with curve 1 ($P_{c\,1}$):		0.457	0.136	0.111	0.147	0.213	
Friction-limited curve speed for curve 2 ($v_{max\,2}$), ft/s:			46.3	66.9	47.2	39.5	
Curve entry speed for curve 2 ($v_{ent\,2}$), ft/s:			55.4	83.5	48.7	63.2	
Curve exit speed for curve 2 ($v_{ext\,2}$), ft/s:			44.1	66.9	44.1	39.5	
Proportion of segment length with curve 2 ($P_{c\,2}$):			0.818	0.333	0.265	0.128	
Friction-limited curve speed for curve 3 ($v_{max\,3}$), ft/s:			70.7	82.4	50.0	101.5	
Curve entry speed for curve 3 ($v_{ent\,3}$), ft/s:			44.1	77.0	44.1	39.5	
Curve exit speed for curve 3 ($v_{ext\,3}$), ft/s:			44.1	82.4	44.1	52.0	
Proportion of segment length with curve 3 ($P_{c\,3}$):			0.045	0.111	0.029	0.064	
Friction-limited curve speed for curve 4 ($v_{max\,4}$), ft/s:				101.4		191.3	
Curve entry speed for curve 4 ($v_{ent\,4}$), ft/s:				82.4		52.0	
Curve exit speed for curve 4 ($v_{ext\,4}$), ft/s:				88.2		72.1	
Proportion of segment length with curve 4 ($P_{c\,4}$):				0.093		0.191	
Friction-limited curve speed for curve 5 ($v_{max\,5}$), ft/s:							
Curve entry speed for curve 5 ($v_{ent\,5}$), ft/s:							
Curve exit speed for curve 5 ($v_{ext\,5}$), ft/s:							
Proportion of segment length with curve 5 ($P_{c\,5}$):							
Distance from edge of right shoulder to barrier face (W_{rcb}), ft:		0.750	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the right side (P_{rb}):		0.429	0.273	0.667	0.412	0.872	
Distance from edge of left shoulder to barrier face (W_{lcb}), ft:		999.000	0.750	0.750	0.750	0.750	
Proportion of segment length with barrier on the left side (P_{lb}):		0.000	1.000	0.148	0.176	0.617	
Proportion of segment length within a weaving section (P_{wev}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to speed-change lane of another ramp (P_{sthru}):		0.000	0.000	0.000	0.000	0.000	
Proportion of segment length adjacent to taper of lane add or drop. (P_{tpr}):		0.000	0.000	0.000	0.000	0.000	
Traffic Data	**Year**						
Average daily traffic ($AADT_r$ or AADTc) by year, veh/d:	2020	12350	3930	13670	1780	1860	
	2021	12350	3930	13670	1780	1860	
	2022	12350	3930	13670	1780	1860	
	2023	12350	3930	13670	1780	1860	
	2024	12350	3930	13670	1780	1860	
	2025	12350	3930	13670	1780	1860	
	2026	12350	3930	13670	1780	1860	
	2027	12350	3930	13670	1780	1860	
	2028	12350	3930	13670	1780	1860	
	2029	12350	3930	13670	1780	1860	
	2030	12350	3930	13670	1780	1860	
	2031	12350	3930	13670	1780	1860	
	2032	12350	3930	13670	1780	1860	
	2033	12350	3930	13670	1780	1860	
	2034	12350	3930	13670	1780	1860	
	2035	12350	3930	13670	1780	1860	
	2036	12350	3930	13670	1780	1860	
	2037	12350	3930	13670	1780	1860	
	2038	12350	3930	13670	1780	1860	
	2039	12350	3930	13670	1780	1860	
	2040	12350	3930	13670	1780	1860	
	2041	12350	3930	13670	1780	1860	
	2042	12350	3930	13670	1780	1860	
	2043	12350	3930	13670	1780	1860	

Proposed ATC B-Line Terminal

All Crash Values 0.000 as Terminal is Eliminated

Predicted Average Crash Frequency

Fatal-and-Injury Crash Frequency

Ramp Terminal Crash Analysis	Year		
Overdispersion parameter ($k_{w\,x\,at\,fi}$):			
Observed crash count ($N^*_{o\,w\,x\,at\,fi}$), crashes:			
Reference year (r):			
Predicted average crash freq. for reference year ($N_{p\,w\,x\,at\,fi\,r}$), crashes/yr:			
Equivalent years associated with crash count ($G_{p\,w\,x\,at\,fi\,r}$), yr:			
Expected average crash freq. for reference year given N^*_{o} ($N_{a\,w\,x\,at\,fi\,r}$), crashes/yr:			
Predicted average crash frequency ($N_{p\,w\,x\,at\,fi}$), crashes/yr:	2020		
	2021		
	2022		
	2023		
	2024		
	2025		
	2026		
	2027		
	2028		
	2029		
	2030		
	2031		
	2032		
	2033		
	2034		
	2035		
	2036		
	2037		
	2038		
	2039		
	2040		
	2041		
	2042		
	2043		

Property-Damage-Only Crash Frequency

Ramp Terminal Crash Analysis	Year		
Overdispersion parameter ($k_{w\,x\,at\,pdo}$):			
Observed crash count ($N^*_{o\,w\,x\,at\,pdo}$), crashes:			
Reference year (r):			
Predicted average crash freq. for reference year ($N_{p\,w\,x\,at\,pdo\,r}$), crashes/yr:			
Equivalent years associated with crash count ($G_{p,w\,x\,at\,pdo\,r}$), yr:			
Expected average crash freq. for reference year given N^*_{o} ($N_{a\,w\,x\,at\,pdo\,r}$), crashes/yr:			
Predicted average crash frequency ($N_{p\,w\,x\,at\,pdo}$), crashes/yr:	2020		
	2021		
	2022		
	2023		
	2024		
	2025		
	2026		
	2027		
	2028		
	2029		
	2030		
	2031		
	2032		
	2033		
	2034		
	2035		
	2036		
	2037		
	2038		
	2039		
	2040		
	2041		
	2042		
	2043		

Crash Severity Distribution (during Study Period)			
Fatal crash frequency ($N^*_{e\,w\,x\,at\,K}$), crashes:			
Incapacitating injury crash freq. ($N^*_{e\,w\,x\,at\,A}$), crashes:			
Non-incapacitating inj. crash freq. ($N^*_{e\,w\,x\,at\,B}$), crashes:			
Possible injury crash freq. ($N^*_{e\,w\,x\,at\,C}$), crashes:			
Total fatal-and-injury crash freq. ($N^*_{e\,w\,x\,at\,fi}$), crashes:			
Property-damage-only crash freq. ($N^*_{e\,w\,x\,at\,pdo}$), crashes:			
Total crash frequency ($N^*_{e,w\,x\,at\,as}$), crashes:			